Analysis of Urban Agriculture Development at Household Level in Pakistan

A thesis submitted in partial fulfillment of the requirements for the degree of

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Submitted by:

Arhama Noor Alam

(00000171296)

NATIONAL INSTITUTE OF TRANSPORTATION

SCHOOL OF CIVIL AND ENVIRONMENT ENGINEERING

NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY,

ISLAMABAD

This is to certify that the contents and form of

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Submitted by:

Arhama Noor Alam

(00000171296)

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Thesis Supervisor

Dr. Abdul Waheed

NATIONAL INSTITUTE OF TRANSPORTATION(NIT)

SCHOOL OF CIVIL AND ENVIRONMENT ENGINEERING(SCEE)

NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY(NUST),

ISLAMABAD

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Signature: _____

Name of Supervisor: Dr. Abdul Waheed

Date: _____

Signature (HOD): _____

Date: _____

Signature(Dean):_____

Date:_____

Dedication

This project is dedicated to my husband who encouraged me and supported me throughout my research.

Acknowledgement

ALLAH is the most merciful and manifest to the mankind who enabled me to accomplish this task.

Further, I would like to extent my gratitude to my research supervisor Dr. Abdul Waheed for his continuous guidance throughout my research. His feedback, encouragement and support helped me to complete this task

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Abstract

With the rapid increase in population and continuing consumption growth, the need for energy, food and other necessities has increased, thus decreasing production. Due to increase in demand of food and increase in prices of transport, food prices have increased significantly. Hence, there is a dire need of urban agriculture to be practices at household level. Urban agriculture is not a fresh concept and many countries are involved in urban farming since centuries. Although, in Pakistan the ratio of people who are involved in urban farming to those who are not farming in urban areas, is significantly low. Home gardening provides food security not just to households with adequate space for gardening but also to the poor and landless people who can grow food at vacant lots, small pieces of homestead land, roadsides or edges of a field, or even in containers. Community gardening with specific rules or associations has also been practiced at old times which has benefited the communities at hard times. Home gardening can provide food by harvesting, preparing, and feeding the family members on the daily basis, hence contributing to food security. This research is conducted to evaluate existing policies regarding urban agriculture in the world through literature review, investigate the existing urban agriculture practices at household level, to determine drivers and barriers toward sustainable urban agriculture practices, to determine community willingness of adopting urban agriculture and to suggest a framework to promote urban agriculture practices. Two sample study areas were selected where urban farming may or may not be practiced. A quantitative survey was conducted and founded that most people were interested in farming fruits and necessary ingredients for cooking but lacked resources like land, money and time. Those who had excess of land available were already farming a little bit. Major obstacles were access of land and lack of time along with knowledge and guidance. Some steps are required at policy level to ensure practices of urban agriculture so that the community can overcome these major barriers. Urban agriculture is a sustainable practice which will help achieve sustainable goals like "end hunger", "end poverty" and "ensure healthy lives at all ages"

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1. Introduction

With the rapid increase in population and continuing consumption growth, the need for energy, food and other necessities has increased, thus decreasing production. Since the production sector has been facing many problem and food and resources have become scarce, the prices of the few products have risen among which is the price of electricity, water, fuel, transport, food including meat, vegetables, fruit and seed needed for cultivating the crop. Hence, there is a dire need to produce food not only in rural areas but also in urban areas to address the issue of food security.

Advances in production will play a significant role in decreasing food insecurity but they will be held back by the limited resources of Earth's lands, oceans, and atmosphere (Conway, 1997). Although there has been a marked growth in the past century causing dramatic decrease in hunger all around the word but still 1 in 7 persons faces some sort of micronutrient malnutrition. (World Bank, 2009). Also, with growing numbers of mouths to feed, urban agriculture partakes a momentous role to sustaining the cities in future (Deestria, 2000). Urban farming must be considered as a vital feature of sustainable urban development due to tremendous urbanization, more home-grown food reliance, and using nutrients stacked in the cities. Urban agriculture along with plans on energy efficiency, high resource yield and policies for controlling urban sprawl, has an important contribution to make towards shaping the cities of the future.

Food production in urban areas is not a first-hand experience in the developing regions of the world (Bryld, 2002). According to The United Nations Development Programme (UNDP) estimate during the mid-1990s, approximately 800 million urban population was involved in agrarian production, either for commercial or survival purposes (UNDP, 1996; Borgue, 2000; Bryld, 2002). Several Asian countries have invested in urban farming to control population growth and food insecurity. China is the world leader in

vertical farming due to state investment. Thailand Environment Institute has assisted to create rooftop farms and indoor vertical farms across Bangkok. In India, rooftop farming is popular in cities like Karela.

"Urban Agriculture is an industry that responds to the nutritional demands of a city, from within that city, with the use and reuse of that city's resources while acknowledging economic and resource use does not settle aspects of regional health, food security, and application of grassroots organizations" (Food and Agriculture Organization of the United Nations (FAO)). FAO has also described Urban and peri-urban agriculture (UPA) as the growing of plants and the raising of animals within and around cities. Food supply can be delivered from variety of range of crops (grains, root crops, vegetables, mushrooms, fruits), animals (poultry, rabbits, goats, sheep, cattle, pigs, guinea pigs, fish, etc.) as well as non-food products (e.g. aromatic and medicinal herbs, ornamental plants, tree products) by urban and peri-urban agriculture. (FAO). Urban agriculture would upsurge local food availability and decrease the expense of groceries. Numerous forms of urban agriculture are: 1) Container Gardening 2) Patio or Balcony Gardening 3) Backyard gardening 4)Rooftop Gardening 5) Cultivation of Vacant Lots 6) Vertical or sky farming 7)Animal Husbandry 8)Aquaponics 9)Community gardening 10) Greenhouses 11)Urban Beekeeping 12)Aquaponics. Urban Agriculture promotes food security and creates a sense of belonging by bringing urban dwellers together. Healthy food is made available and easily accessible that is respectable enough by the community. It is a popular phenomenon being practiced by 800 million people worldwide which was at that time 30% of the world's population (UNDP 1996).

Vertical farming is least affected by severe weather conditions as special environment is provided to the plants which can make them grow despite their actual seasons. Community gardening is the type of gardening in which multiple individuals farm together, hence creating a sense of community and more social interactions in an otherwise secluded environment of the cities. Rooftop gardening is done majorly to reduce temperatures of the households, mitigate the urban heat island effect and it also contributes to

the overall greenery in the city. Urban greenhouses are available in small sizes with wheels which can be used in a yard, small garden, balcony or any other small space in the house to grow vegetables, salad, fruits and other herbs. Rooftop greenhouses are being used by researchers and as a business opportunity. Rooftop greenhouses require more structural support beneath them because of the added weight. Greenhouses offer a controlled environment where crop can be grown throughout the year giving urban farmers an added advantage. Aquaponics involves the use of a system that catches stormwater from inside the city and then creates a recirculating system which sustains itself in artificial fish ponds or tanks. It is an efficient way of rearing crops and a protein alternative.

 Basically, urban farming can be done anywhere on walls, balcony, vacant lots, containers, in special buildings, greenhouses among others. Nonetheless, it can use smallest piece of land and can also be done on the largest land parcel available. But, however, more profit would be generated using advanced technologies if accessibility to land is an issue.

Figure 1.1 Urban Agriculture on walls

Source : Dawn Images (https://images.dawn.com/news/1184972)

Figure 1.2 Rooftop Greenhouse

Source : https://ggs-greenhouse.com/blog/rooftop-greenhouse-vs-vertical-farming

Majority of poor income urban dwellers catch diseases which limit their ability to work and learn according to a research conducted by World Bank (UNDP, 1996; Bryld, 2002). Home gardening provides food security not just to households with adequate space for gardening but also to the less fortunate who can grow eatables at vacant lots, pieces of farmstead land, sides of a road or a field, or even containers. The concept of community gardening with specific rules or associations is also not new. Urban farming can provide food by harvesting, preparing, and feeding the family members on the daily basis, hence contributing to food security. Gardening may be done using nearby obtainable planting supplies, eco-friendly fertilizers, fencing and native strategies to control pests (Marsh, 1998). Thus, urban gardening at some level is a production system that can be adopted by the poor.

Growing food in cities is an ancient practice as opposed to the general thinking of planners that urban agriculture is a messy practice, and no one is aware of it. 1.4 million allotment gardens still exist in Germany also known as "Schrebergarten", the origin of whom dates to after the World War I. Also, there are millions of home gardens in Germany. Germans had an allotment system for the garden related issues which were to be solved by the association and only if remained unsolved were referred to the hearing at City Hall (Drescher, 2001). During the mid-1970s, a program called "Operation Feed Yourself" was initiated to overcome the food shortage in Accra (Nugent, 2000). In New York and Detroit (America), thousands of acres of land have been allotted to jobless people with the purpose of growing food (Bakker, 2000). Singapore produces enough meat to feed its inhabitants. It also produces 25% of the vegetables. Bamako, Mali, is producing enough vegetables and half or more than required chicken. Dar-e-Salam has now 67% of households practicing agriculture. 65% of households in Moscow are also engaged in agriculture production (Smit et al, 1995). 40% of the households in Cagayan de Oro (Philippines) have backyard gardens which are producing leafy vegetables and fruits. Also, in Cagayan de Oro 96% of elementary schools have school gardens where allotted size of a garden is 500-1000 square meters.

Vegetables are regarded as poor food in the area, so farming families because of their low incomes consume 85% of vegetables and 7% meat whereas upper socio-economic class consumes 64% vegetables and 78% meat. Mostly, consumers don't buy all their vegetables from markets due to backyard gardening (Potutan et al., 2000). According to PUVET survey, in a sample of average age of 7.86 years and 19.11 kg average weight, 69% of pupils were malnourished but very few belonged to farming households.

Although due to excessive pollution in the cities, it is recommended to cultivate yields at least ten meters away from busy roads especially in regions using lead fuel. Precautions are required in land contaminated with heavy metals such as lead and cadmium. But with the use of additional amount of lime and high organic matter, it can help immobilize heavy metals.

1.1 Problem Statement

With the increase in growth population and growth consumption in Pakistan, there is a dire need to increase practice of urban agriculture with its awareness to ensure food security.

1.2 Research Questions

- o How to promote urban agriculture in order to cater food insecurity?
- o What is the existing situation of urban agriculture practices at household level?
- o What are the drivers and barriers of urban agriculture?
- o Is the community willing to adopt urban agriculture in the study area?

1.3 Scope of work

While Urban Agriculture in literature might mean growing food and livestock on urban and peri-urban areas but focus of our research will be solely on growing plant-based food on urban grounds only.

1.4 Objectives

Goal of this research is to develop a framework for promotion of urban agriculture in a metropolitan city in order to cater food insecurity

o   To investigate the existing urban agriculture practices at household level

o   To determine drivers and barriers towards sustainable urban agriculture

o   To determine community willingness of adopting urban agriculture

o   To suggest a framework to promote urban agriculture practices

2. Literature Review

2.1 Rural Economy

In most poor countries, large population lives in rural areas where their main livelihood comes from agriculture. This adds 25% of value to the economy of the developing countries. (Goldin, 2010) The ratio of urban dwellers to rural dwellers was 6.7 to 1in 1990. By 2025, the ratio will be 3 urban dwellers to 2 rural dwellers (Satterthwaite et al., 2010). In agricultural economy, any country does not produce more than the immediate consumption requirement from its economic system due to low productivity and low output per head. The population which survives on agricultural economy; be it 17th century Europe or 19th century Africa, lives under the threat of harvest failure or disease causing an increase of 70 to 100 per 1000 death rate (Mathias, 1981).

Figure 2.1 Rural Economy of Pakistan

Source : https://www.newscottage.com/how-to-revitalize-pakistans-agricultural-sector-and-rural-economy/

2.2 Rural to Industrial Economy

Britain was the first country to have industrialized economy which happened spontaneously and without any government policy (Mathias, 1981). After the industrialization of European economy during 1800 to 1996, per capita income growth rate increased from almost no growth to 1.8 % per year. On the other hand, rate of growth of European population became seven times its previous rate which was 0.8% per year. Continuous growth rate of human capital stimulates shift from agriculture to industry (Tamura, 2000). An area where the quantity of land per farmer increases will postpone the shift from agriculture to industry according to model described by Robert Tamura.

In the 18th century, most of the Americans were living in self-sufficient rural areas. The Industrial Revolution observed the development of large urban centers such as Boston and New York City, and

stimulated worker's gigantic internal immigration. The Industrial Revolution also stimulated the rise of untrained workforce (Matus,1998).

The monetary value produced by industry and services beat that produced by the primary sector (agriculture, forestry, mining, and fishing) for the first time around 1940. The workforce engaged in industry and services topped that working in the primary sector around the 1980s(Satterthwaite, 2007; Satterthwaite et al., 2010).
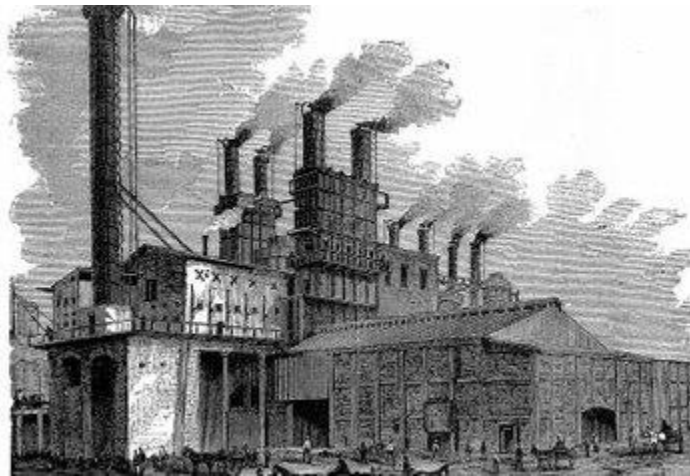
Figure 2.2 Industrial Revolution of America

Source: https://education.seattlepi.com/

2.3 Urbanization

In 2008, world's urban population surpassed the population of rural areas for the very first time (Satterthwaite et al., 2010). Also, it is estimated that 70% of world's population will be living in cities by 2050 (Arif et al., 2009). Rural to urban migration is primary driver of urban agriculture (Bryld, 2002). Urbanization is a phenomenon of population intensification which may occur in two ways 1) the proliferation of concentration points 2) Expansion in size of individual concentrations. It can sometimes stop but it usually proceeds until adverse conditions are reached (Tisadale, 1941). The ancient cities used to be very small and supported by rural populations. The process of urbanization has advanced

promptly since 1800. A rise in the rate of urbanization in developing countries is neutralized by the reduction in rate of urbanization in older industrial countries (David, 1955) .Urbanization is usually the consequence of net rural to urban migration and the increase in urban population due to expansion of urban peripheries (Tacoli et al., 2015). According to policy makers, urban planners and researchers, urbanization is considered as one of the driving factor of food prices. With actual agricultural productivity trends, nothing indicates that higher rates of urbanization are connected to decreased agricultural yield of one of the continents. (Stage et al., 2010).

According to the UN- HABITAT (2001), around 34% of the population resided in urban areas in the sub-Saharan Africa. The UN-HABITAT (2008) further emphasizes that 95% of the world's urban population growth will take place in cities in developing countries over the next forty years. Urban expansion is an enormous strain on the agrarian land to be converted into the built-up land (De Jong et al., 2014). Accelerated urbanization and increased economic growth has caused land scarcity for agriculture in China over the last two decades. China is responding with positive policies to address the shortage of agricultural land, and to ensure food security (Chen et al., 2007). A large amount of rural labor moves out of rural areas and into the cities causing urbanization. China's urbanization rate accelerated from 17.91% to 57.32% (National Bureau of Statistic of China, 2016).

According to the United Nation's World's Urbanization Prospects of 2004, urban population of the world is envisioned to go up by approximately 2 billion in following 30 years, and the world's rural population is expected to drop to approximately 3.2 billion in 2030 from 3.3 billion in 2003 (World's

Urbanization Prospects, 2004; Hussain, 2014).
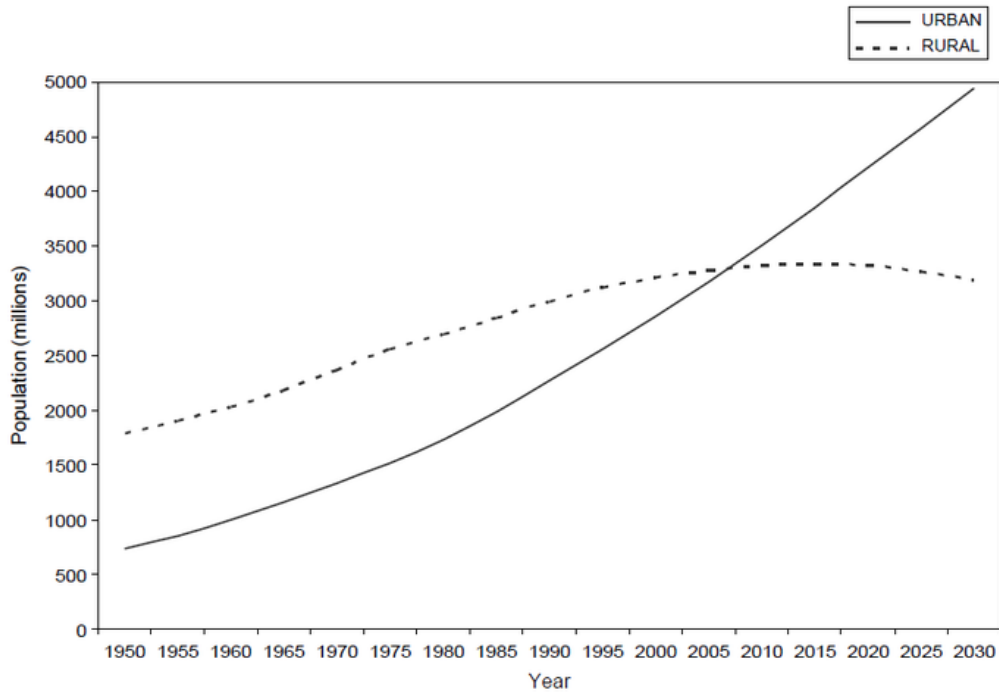
Figure 2.3 Estimated and Projected World's Urban and Rural Population from 1950 to 2030

Source: World's Urbanization Prospects, UN (2004)

World's urbanization prospects were revised in 2018 by United Nations. According to the revised report, huge disparity exists between urbanization patterns of the most developed countries and the developing countries of the world. Most of the people of developed countries already live in urban centers. Although, urban population in less developing countries is rising significantly which has increased world's share of urban population. . In 2018, three times more urban dwellers were projected to reside in the less developed countries as compared to the more developed countries (3200 million vs. 1000 million). By 2050, the less developed regions are estimated to constitute 83% of the world's urban population and 87% of the total world population which consists of 5600 million urban dwellers.(United Nations, 2018)
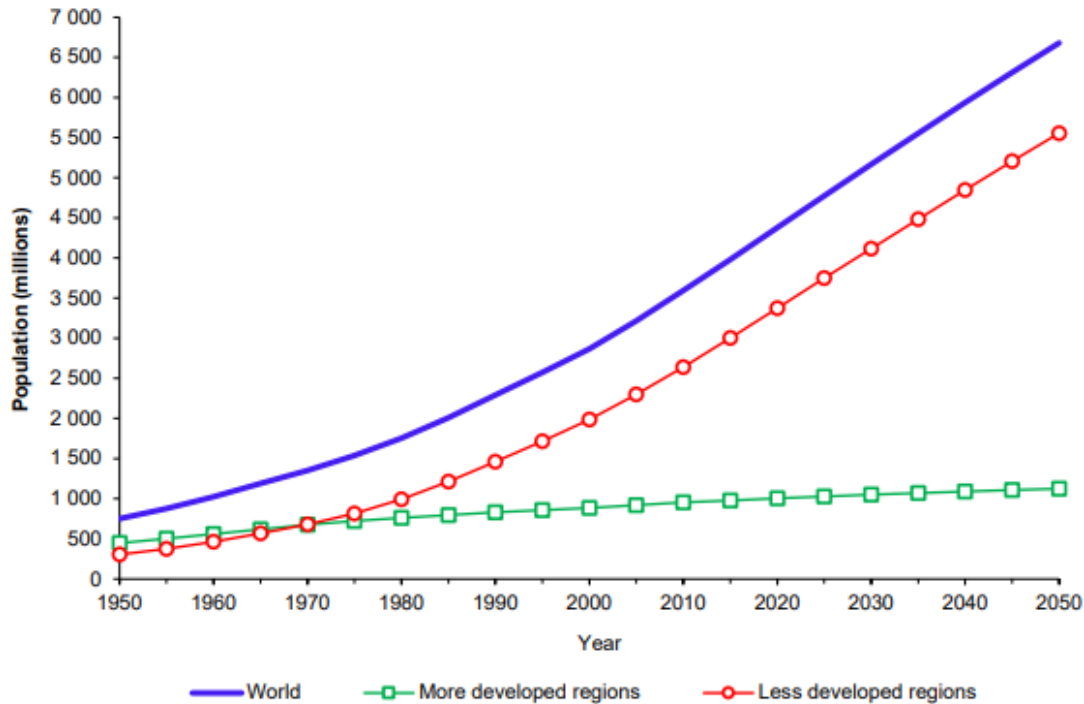
Figure 2.4 Revised Urbanization Prospects of the world, more developed and less developed world

Source: Revised Urbanization Prospects of the World by United Nations in 2018

2.4 Aftermaths of Urbanization

Urbanization led to decrease in agrarian worldwide and hence intensifying food insecurity. According to the IFAD/WFP/FAO (2011), globally reduced number of food insecure people is 925 million. Out of these 925 million food insecure people who sleep starving, one child passes away daily (Frimpong, 2013). Around 34% of the population presently resides in cities in sub-Saharan Africa (UN- HABITAT, 2001). In 2008, the UN-HABITAT emphasizes that 95% of the planet's urban population growth over the subsequent forty years will take place in urban areas of the developing regions. In most of the countries, the governments are giving importance to manufacturing and service sectors while neglecting agricultural sectors, decline of peasant agriculture and increase in agroindustry (Maxwell, 1996).

The urban population of developing countries like Nigeria and India is increasing as a result of natural growth and rural to urban relocation. This quick rise in urbanization pretenses new and various

challenges for food security in Nigeria including other developing countries. Poor urban population who do not have fixed incomes rely on purchased food which is contributing majorly to Nigerian household food insecurity (Ekpenyong, 2015). Also, in India the main causes of food insecurity are shrinking of arable land and urbanization. With the increasing trend of urbanization caused due to poverty and rural food insecurity, slums and squatters are built in the cities which consequently contribute to urban food insecurity. Food insecurity is severe in above 4200 small Indian towns (Chakravarty and Dand, 2005).

2.5 Urban Agriculture as a key to meet SDGs

Urban agriculture can be practiced to meet Sustainable development goals like : "End poverty in all its forms everywhere", "End hunger, achieve food security and improved nutrition and promote sustainable agriculture" and "Ensure healthy lives and promote well-being for all at all ages".

2.5.1   Urban Agriculture as a mean to end poverty

Urban agriculture has provided jobs, food, beautification, education, environmental enhancement, inspiration and hope (UNDP 1996; Mougeot ,1994). In most of the countries, it is delivering food, new jobs, and green spaces in the most challenging urban agglomerations. Urban agriculture can act as a "band-aid" while trying to eradicate poverty, mal-nutrition and unemployment. In most of the cases, urban agriculture is determined by increased food insecurity and poverty. It may be a step ahead in term of policy making but it can only address food insecurity at a community level and will be a desperate survival strategy (Martin, 2000). High-income urban dwellers cultivate food for further accumulation of wealth through production of yield crop near the market. Medium income urban dwellers use urban agriculture to secure family well-being. However, majority of urban dweller engage in urban agriculture for survival. Low income urban dwellers rarely have any open space to grow food. Consequently, poor families end up selling their grown food to afford rent and medical expenses even if they do not have anything to eat (Freeman, 1993; Atukanda and Maxwell, 1996; Rigg,1998; Bryld,2002). In Cagayan de

Oro, socially most disadvantaged people the garbage pickers were given a site close to the city's landfill site to use for farming purposes.

2.5.2 Urban Agriculture as a mean to end hunger

World bank (1986) has defined food security as: "Access by all people at all times to sufficient food for an active healthy lifestyle". One of the SDGs is to eliminate hunger and achieve food security. Hunger is inverse of food security and is defined as "not being able to get enough, nourishing, individually appropriate food through proper channels". It is believed by the agriculturalists that indoor farms within the cities can help in solving world's hunger issues. Also, vertical farms can feed up to 10 billion people independent of weather and use of extra land. A case study which surveyed farming and non-farming houses in Kampala concluded that there was a relationship between household food security and wealth, land size, the keeping of livestock, gender, and education (Nyapendi,2010). As a result, a relationship between urban agriculture and household food security was evidently established, something already proclaimed by previous studies of Nairobi, Kampala and Nakuru. Also, food security directly affects domestic security, economic development, social equity, public health, and land use security

(Morgan,2009).

Figure 2 5 Pillars of Food Security

Source : https://www.bigpicnic.net/about/food-security

2.5.3   *Urban Agriculture to ensure healthy lives at all ages*

Global food distribution systems make people pay less money for more calories than earlier, but the

calories are inadequately nutritious which contribute to both nutritional shortcomings and persistent

health troubles, especially amid the urban poor (Morland and Filomena, 2007; Nestle. 2002; Heyen et.

Al.,2012). Moreover, food supply chains sell most healthy and nourishing foods very costly hence

making them the least accessible, particularly in urban areas (Larsen and Gilleland, 2009; Heyen et. Al.,

2012). In the last few decades supermarkets have left the central cities (Becker 1992), which made most of the urban dwellers to buy food from so-called convenience stores with poorly kept grocery shelves (Ashman et al., 1993; Morland and Filomena, 2007). Withdrawal of supermarkets along with advent of fast food supply chains has led to production of unhealthy, unaffordable, and unsustainable urban food environment (Curtis and McClellan, 1995; Schlosser, 2002). The rapid increase of high calorie and low nutritional value industrial food to which has been referred as "Food like substances" by Michael Pollan, has led to obesity in America causing lifelong illnesses like diabetes and hypertension (Goran et al., 2003; Swallen et al., 2005). The distance between place of production of food and place of consumption is a source of dissention and mistrust between producers and consumers (Lyson, 2014). One approach to erasing this gap between the producer and consumer is through urban agriculture (Jarosz, 2008). Reducing the distances to the minimum might allow transparency in the quality and price of the food (Allen and Kovach, 2000). Urban agriculture can be used to provide fresh fruits and vegetables which are always accessible by the inhabitants who are growing themselves or buying from a nearby farmer or a local store. Consumption of healthy food will lead to healthy life and well-being of people at all ages.

2.6 Urban Agriculture and Its Forms

Urban agriculture is an activity that produces processes and markets food, fuel and other outputs (Islam and Siwar, 2012). Urban agriculture has been defined as "the production of agricultural goods by urban residents" (Zezza, 2010). Urban agriculture is also defined as "an industry located within (intra-urban) or on the fringe (peri-urban) of a city or metropolis, which grows or raises, processes and distributes a diversity of food and non-food products" (Mouget, 2000). "Urban agriculture is the carrying out of farming activities in built-up areas where open space is available as well as keeping livestock (dairy, cattle, goat, sheep, pigs and foul) in built-up and peri-urban areas" (Mwalukasa, 2000). Recent technologies used for urban agriculture are water collection, localized shortage and distribution,

wetlands drainage, frost protection and slope terracing (Mouget, 2000). Urban agriculture stabilizes household food security and protects against massive malnutrition. Poor households cannot afford a variety of nutritious food but with urban agriculture they can (Mbiba, 1998; Islam and Siwar, 2012). Delocalization is required to decrease food miles to prevent food insecurity globally (Robert,2007) and minimize the effects of urbanization (Islam and Siwar, 2012) in the developing world as well as the developed world (Pataki et al., 2006).

Green urban architecture also known as urban agriculture targets to unite food, production and design to produce food on a hefty scale in and on buildings. Urban agriculture is of mainly of two kinds: On-plot farming and off-plot farming. On-plot farming is the practice of agriculture at residential stand like homes. On-plot cultivation is legal, but animal husbandry is mostly not allowed due to noise, smell and other reasons. Whereas off-plot farming is practiced outside home on public land which may be reserved for future development of any kind (Mayo, 2013).

Advanced forms of urban agriculture include community gardens, rooftop gardens, rooftop green house, hydroponic greenhouses, commercial city farms, urban aquaponic farms or fish farms, urban beehives, smallscale household farms, indoor farming and vertical farming defined as z-farming (Specht, 2014). Rooftop gardening reduces temperatures of households and decreases excess heat absorption from the sun during summers. It is expected to save energy consumed for air-conditioning in buildings (Wong et. Al., 2003). As a result, it mitigates the urban heat-island effect in the cities. Moreover, vegetation grown

on the rooftops can make better the dry climate of urban areas with humidification by transpiration of plants and also help in air purification (Sendo et. Al, 2006).

Figure 2.6 Rooftop Gardening

Source : https://homesteading.com/roof-garden-transformation-ideas/

Vertical farming relies on the perception that the most practical cultivating conditions can be created around the crop instead of struggling to adjust to the natural environment, eradicating the unpleasantness that habitually escorts higher crop production (Despommier, 2010). Productivity and sustainability objectives cannot be reached due to some limitations which are lack of nutrients and water, humidity and temperature nonconformity, scarce insolation, presence of pests, and unstable energy supply. It is recommended that LED lighting systems along with structural design and covering life stages of plants in premium conditions can be used to deliver adequate illumination. This perceived aeroponic system might deliver spray of both water and nutrients reducing weight load concerns from hydroponic systems

or soil. Nonetheless, there is a need to manage the consequent humidity to avoid likely fungal diseases and condensation through sterilize and completely airtight atmosphere at every step. However, life cycle analysis (LCA) will furthermore be required to access the energy costs for lighting, carbon emissions and water usage in the concrete used for building and loss of agro-ecosystem services (Germer et al., 2011).

Figure 2.7 Vertical Farming

Source : https://ssir.org/articles/entry/feeding_the_future_of_agriculture_with_vertical_farming

The term "community" in community gardening signifies the fact that this method of gardening implicates the union of more than one individual put together in different settings to grow food among other things; for instance in schools, city blocks, neighborhoods, prisons, nursing homes, hospitals and

faith communities. Community gardens are advantageous for and enjoyed by individuals of any race, age, socioeconomic status, and ethnicity, along with the disabled (Draper and Freedman, 2010).

Figure 2 8 Community Gardening

Source **:** https://www.gardeningknowhow.com/special/urban/community-garden-information.htm

2.7 Practice of Urban Agriculture Worldwide

20 million people are practicing urban agriculture in West Africa (UNDP,1996). 70% of urban farmers constantly grew food in their urban lots for over 10 to 20 years in Ghana (Drechsel, 2014). In Africa,

more precious and worthy agrarian lands are those with direct access of water, which are mainly government plots alongside watercourses or lowlands with low groundwater table levels. The very reason behind their value is that earnings are more in dry season when there is limitation in water supply(Dongus, 2010). Group of farmers who may or may not be working together, grow food in urban open spaces (Jacobi et al, 2000). The farmers are majorly rural migrants (Dreschet et al, 2006). Urban farmers keep changing crops throughout the season to produce most lucrative ones (Danso and Dreschet, 2003). The crops grown in urban farms are fruit, rice, root crop, cereals, vegetables, oilseed crop and legumes. A complete record of spatial data of production of urban food exists in Dar-es-Salam (Dongus, 2010). During 1967-1991, the number of families involved in urban farming has rose from 18 to 67% in Dar-es-Salam. Thus, urban agriculture is the main employer of Dar-es-Salam after trivial trade (UNDP, 1996; Ratta and Nasir,1996). Community and public lands along with roadsides and airport buffers along with areas which are not appropriate for building such as floodplains, sides of streams, drainage way-leaves, swamps and steep slopes have also been cultivated as a part of urban agriculture in the last few decades (Freeman,1993; UNDP, 1996; Bryld,2002).

As farms take lots of space than houses, it is a popular practice to have crop fields outside the city boundaries or fortress walls whereas old European towns have belts of fields spreading out from villages, towns or streets. However, kitchen gardens were always there, and livestock has permanently been close to home (Mumford, 1961; Steel,2008). In the beginning of previous century, refrigeration for home-use was invented so because of lack of refrigeration and poor road conditions, either livestock would come into towns on their own feet for butchering or to be raised in urban grounds. Citizens would gaze their livestock in "commons" now known as parks in industrial countries' cities and markets were places in cities where farmers would come to put their crop up for sale. In 1960s, sub-urban food and superstores came into existence (Steel, 2008).

In the start of the 1980s, urban agriculture was practiced by just 10–25% of the urban population in Africa , while equal to 70% African urban population, and almost 60% Asian urban population have become urban farmers in the 1990s (Rogerson, 1997).

Uganda is a landlocked country whose capital is Kampala. Kampala is a busy city, but urban farming has always been a part of it. Food crops dominate Uganda's agriculture produced by around 3 million farm households (David et al, 2006). In Uganda, 56% of municipal land was utilized for farming and 70% of all consumed poultry products were supplied by the city itself in 1992 (Maxwell, 1993). 49% of Kampala's families are engaged in urban agriculture (David et al., 2006).

2.8 Worldwide Policies for Urban Agriculture

Urban agriculture is perceived as a fundamental component of Community Food Security (CFS) which is developing at a steadfast rate in North America, but it focuses more on community food security rather than individual. CFS includes growing stronger producer/consumer relationships, strengthening the growth of other food markets, guarding fields from built-up development, assisting rural and urban communes, watching over government food support systems, etc. (Anderson & Cook 1999, CFSC 1999b, Martin, 2000).

In USA, wartime gardening became a hot practice during World War I and II to ensure food security and patriotism. The movement was promoted by National War Gardening Commission through launching series of posters, manuals, cookbooks, signs and poems in 1917. This persuaded civilians to participate in the war by growing food. In 1917, US $350 million worth of food was yielded by 35 million war gardens and in 1918, US$ 256.0 million worth of food was accounted by 5.3 million war gardens according to the National War Garden Commission (Pack, 1919; Mok et al, 2014). War Food Administration bracketed gardening with civic responsibility, dignity, and patriotism through National

Victory Garden Program. These victory gardens helped reduce demand of food processing and canning and decrease in food transportation which reduced use of railway carriers and freed up resources for the armed forces. In the US, 40% of the nation's fresh vegetables were produced by 20 million victory gardens (Basset, 1981). The concept of victory gardens is again being promoted to fight against corona virus calling it World War C (Sweetser,2020). In 2010, First Lady Michelle Obama led the foundation of first vegetable garden since Eleanor Rossevelt's Victory Garden. She also started "Let's Move" initiative in 2010 that recommends eating nutritious food and home gardening to help reduce obesity in kids (Let's Move, 2010).

Figure 2.9 Logo of Let's Move Initiative, 2010

Source: www.arsh.org/news
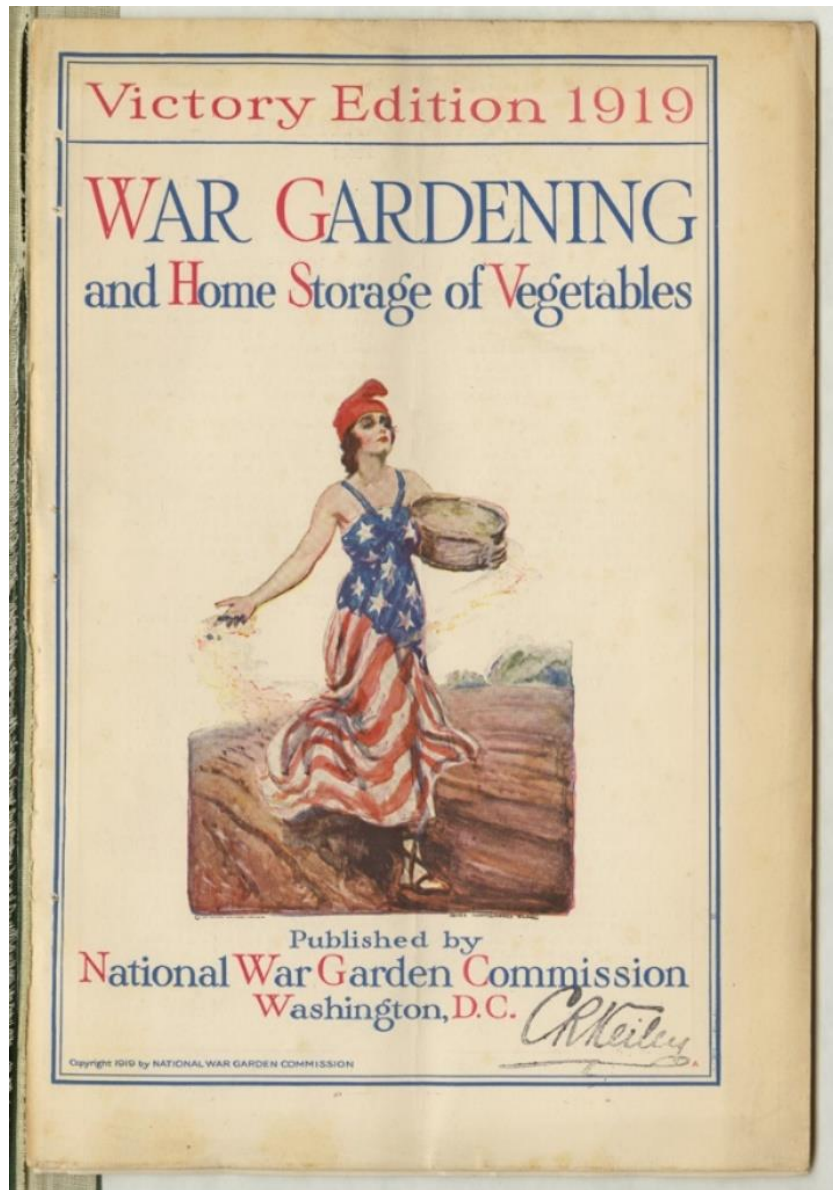
Figure 2.10 US Victory Gardening Compaign Book Cover Page

Source : https://www.virginiahistory.org/collections-and-resources/virginia-history-explorer/victory-gardens

Figure 2 11 American Poster for promoting victory gardens in WWII

Source : https://en.wikipedia.org/wiki/Victory_garden

In Toronto (Canada), Food and Hunger Action Committee was established to minimize hunger, assist

food-based programs, improve health and nutrition in December 1999. Toronto City Council committed

to an agreement which promoted food safety programs and services to encourage community gardens, protect local agricultural land among other goals. This agreement was called Toronto Food Charter. The council also committed to "The Growing Season" which was basically an action plan to accomplish these targets (Food and Hunger Action Committee, 2003). In 2011, Canadian national government formulated People's Food Policy which recommended people to give a boost to production of local food , for example via urban agriculture (People's Food Policy Project, 2011).

Nearly 200 years ago, to fight hunger and poverty "gardens for the poor" arose in Europe. Massive number of people was living in adverse conditions as a result of industrialization and urbanization, which compelled ruling people to take hold of the situation through some countermeasures (Leutenegger and Martin, 2000). In the start of 19th century some urban centers gave the unfortunates a piece of land for food cultivation which they could oversee themselves. City of Kiel was the first one to make an effort. These gardens were meant to eradicate poverty and riot. Land occupied by allotment gardens is ranges from 200 to 400 square meters Majority of these gardens had a little space for storage of gardening equipment. Allotment gardens shaped a cushion for food security, particularly in emergency or crisis. So, allotment gardens helped ensure food security in the time of crisis. The foundation of a productive and stable system of allotment gardens was put down by establishing small-scale gardeners' associations in the cities. The council provides the land, creates a water scheme and finally marks the boundary of the area. The gardeners have to pay minimum rent for the land parcel and must attend to specific responsibilities inside the association. The organization of farmers in garden associations has also grown to be a good way for gaining knowledge about democratic rules. Organic farming and full extermination of pesticide use in public owned urban allotment gardens is being seriously promoted by new areas in most German cities. If the gardeners had any issues, they were solved by the association and only if remained unsolved were referred to the hearing at City Hall (Drescher, 2001).

Figure 2.12 Allotment gardens of Germany

Source : https://germanysustainablecommunities.wordpress.com/2013/12/10/urban-agriculture-in-germany/

191 cities of the world signed The Milan Urban Food Policy Pact on the 15th of Oct, 2015. The pact was presented in front of UN Secretary General named Ban Ki-Moon on the official World's Food Day .The mayors and representatives of cities committed to develop sustainable food systems that are comprehensive, diverse, strong and secure that provide nutritious and inexpensive food to everyone in human rights-based agenda, that minimizes waste and preserve biodiversity while adjusting to and alleviating climate change effects (Milan Urban Food Policy Pact, 2015).

2.9 Food insecurity in Pakistan

Pakistan is witnessing an exponential growth in its population. According to the latest census figures, the total population of Pakistan in 2017 was 200.2 million people. Looking back, in the year of 1960, Pakistan had a population of 45.9 million people. The increase in population causes an increase in urbanization. 17% of the population were reported to be living in urban areas in 1951. 32.52% people

resided in urban centres in 1998. 36.44% people were living in urban centres during 2017. 50% of the total population of Pakistan to be projected in urban areas by 2025 (Ishrat Hussain, 2014; Pakistan Bureau of Statistics, 2017).
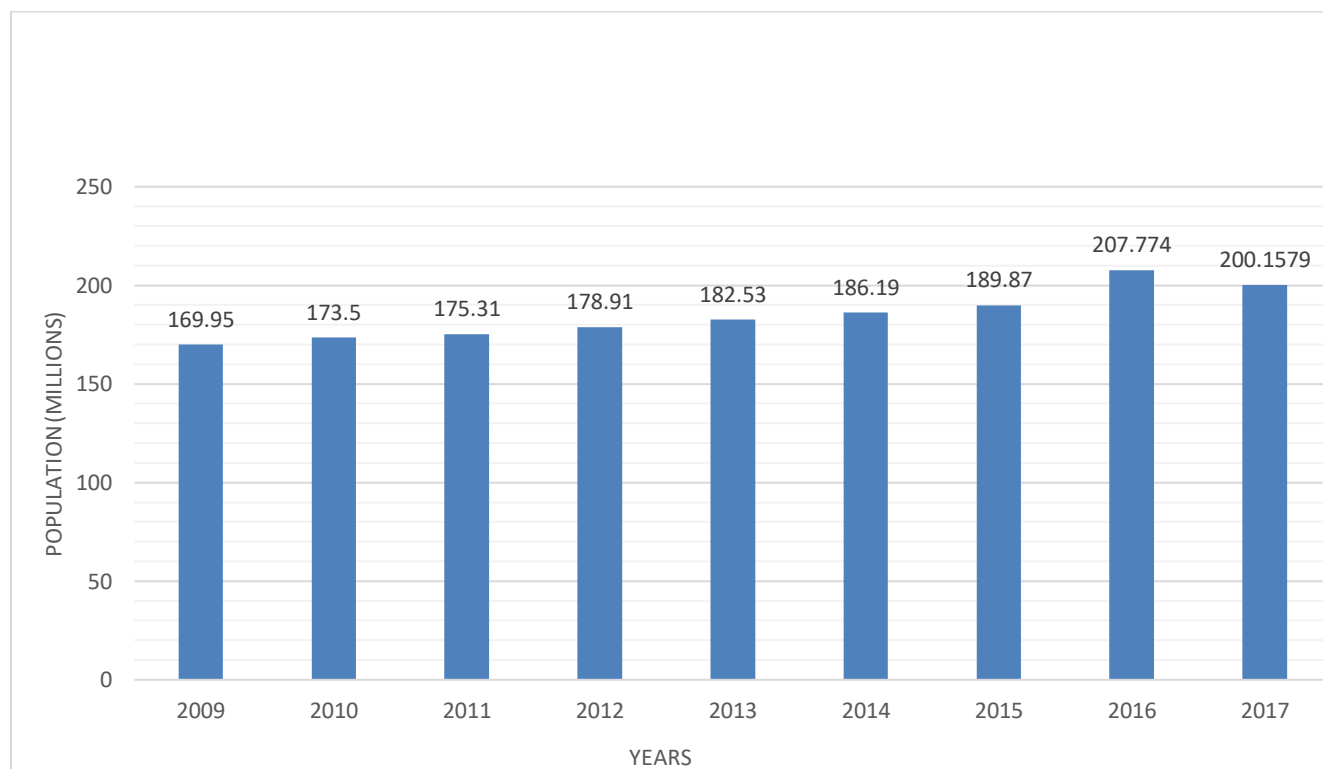
Figure 2.13 Population growth of Pakistan over the years

Source: Pakistan Bureau of Statistics /Tradeeconomics.com

In Pakistan, 4 out of 10 children under five years of age are short as compared to their ages while 17.7% have low weights for their heights. The double burden of malnutrition is becoming increasingly apparent, with almost one in three children underweight (28.9%) alongside a high prevalence of overweight (9.5%) in the same age group. The prevalence of overweight among children under five has almost doubled over seven years, increasing from 5% in 2011 to 9.5% in 2018.

Table 2.1 Child Malnutrition Data by National Nutrition Survey of 2018

	Stunted	Wasted	Underweight	Over-weight
Total	40.2%	17.7%	28.9%	9.5%
Urban	34.8%	16.2%	24%	9.6%
Rural	43.2%	18.6%	31.6%	9.4%

Source : Nutritional Survey of Pakistan, 2018

According to Nutritional Survey of Pakistan 2018, 63.1% of the households of Pakistan are food secure whereas 36.9% remains insecure. 75.6% of GB, 70.9% of KP, 52.9% of Sindh, 67.6% of Punjab, 52.3% of Balochistan and 68.9% of AJK is food secure while 3.7% of GB, 11.8% of KP, 26.0% of Sindh, 14.2% of Punjab, 35.3% of Balochistan and 18.1% of AJK is severely insecure. Province-wise household food security is shown in the Figure 2.14.
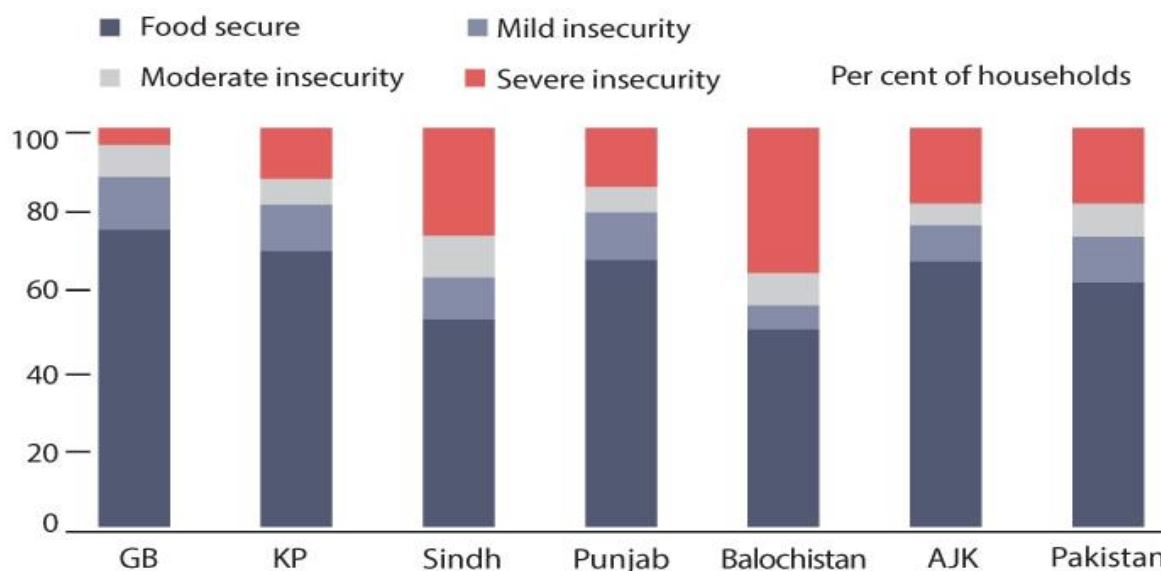
Figure 2.14 Household Food Security in Pakistan by Province/ Region

Source: National Nutritional Survey 2018; Ministry of Health and UNESCO

2.10 Urban Agriculture Policies in Pakistan

Pakistan Agriculture Research Council have formulated a vision regarding kitchen gardening to grow vegetable and herbs at household level in order to make a considerable contribution to food security of the poorest class. The objectives of this project are to create awareness about kitchen gardening, develop skills for growing fresh and safe vegetables without usage of any pesticides, grant complete set of production technology including quality seedlings and potted plants of summer and winter vegetables, establish "Kitchen Gardener's Clubs (KGC)" to provide advisory facilities at door step. Horticultural Research Institute (HRI) through its Kitchen Gardener's Club will provide trainings, seedlings, and potted plants for their kitchen gardens. Kitchen Gardener's Club members will be encouraged to become service provider or entrepreneurship for the members (PARC).

There is a need for clear and agriculture-inclusive local ordinances in Pakistan which provides direction for local farming in urban areas along with implying urban agriculture as a primary or accessory use in zoning regulations.

2.10 Barriers faced by Urban Dwellers

When communal groups turn into a critical mass of people who want to practice urban farming, they run into limitations and barriers of farming in an urban space. These barriers vary from access to seeds, water, land and technical support to zoning, public health laws and other municipal regulations about agriculture as an activity in the urban areas. (Bourque, 2000).

According to Lovel (2010) hurdles faced by urban agriculture are restricted access to land, severe competition from other land uses, lacking infrastructure, shortage of research on human risks in growing food and lack of skills and experience in urban agriculture. Tropp and Barham (2008) identified needs for uniformity in food safety and processing regulations, for clarity in zoning and business permit requirements, and for better policy coordination between the national United States Department of

Agriculture Food and Nutrition Services and the regional and local Women, Infants and Children offices. Lawless and colleagues (1999) identified barriers to direct markets for farmers such as community supported agriculture (CSA) operations, and indicated that farmers have an interest in working with wholesalers. Erickson and colleagues (n.d.) examined barriers to urban agriculture in Seattle, focusing primarily on local ordinances, and noted stakeholder desire for greater knowledge of who is responsible for regulations. Lack of clear ordinances and zoning issues have made urban farmers hesitant in capital investments in land, buildings, and equipment (Castillo et al, 2013).

2.10.1 Access to Land

Major obstacle for urban agriculture is access to land. The big cities have mostly no spaces left. They even do not have enough green spaces. Even if there are unused private or public lands in the cities, the prices are extremely high. Also, when government does not regulate specific land-uses for farming purposes, rent becomes a major obstacle. It is believed by the authorities that if rent is not paid by urban farmers, urban farming might be an economically and environmentally inadequate use of land. Moreover, studies have found that urban farmers are still using municipal water supply, which can cause serious water shortage in the cities. In some cities, the predicament has been mitigated by availing treated wastewater for irrigation. Drip and underground irrigation systems are the low-cost alternatives which can be used to increase water efficiency and safe use of low-quality water resources. In areas with mostly privately owned lands, private owners need to be convinced that their land will be protected and will be of good use. The lands need to be rented to the urban agriculture administrating organizations on a relatively low rent so that urban poor can benefit by farming vegetables and fruits there. In Cagayan de Oro, they have convinced the private owners to build model allotment gardens who have given the land free of cost to the gardening sector (Holmer & Drescher, 2005).

2.10.2 Zoning Regulations

Some cities might not permit the sale of locally grown food. For instance, in Berkely, California, urban dwellers were not given permission to sell locally grown crop because " it is neither a permitted nor accessory use". Now Berkely Planning Commission has made changes to the zoning code and created a definition of "Non-processed edibles" which incorporates nuts, honey, fruits, vegetables and shell eggs. Meat has not been included in this definition of non-processed edibles (Berky et. Al , 2013). In interviews conducted in a research in Chicago's Metropolitan City, vague and unfriendly developments were noticed by planners as a problem. A planner stated that nothing is forbidden, but it is not clearly permitted, or officially documented. It does not particularly state that we authorize producing food, nor does it mention that we forbit it. Urban farmers might be hesitant to make serious investments in lands, equipment and building owing to these regulatory issues. Zoning codes make obstructions for numerous urban farmers who were engaged in urban agriculture on land that was not zoned for urban farming. Zoning codes created hindrances for many urban farmers who farmed on land that was not zoned for urban agriculture. Zoning has become one of the biggest barriers along with special use permits as mentioned by one of the farmers. One of the urban farmers pinned down that gardens are believed to be decorative in his suburbs. So, zoning codes in the municipality of Chicago does not categorize as a potential primary land use. They can be in the side and back of houses. So special use permits are necessary to use a piece of land mainly for farming for instance having a garden on an empty plot. Another planner clarified that a plot cannot be treated as a community garden as an accessory requires a primary use. Thus, it would demand to be an exemption to zoning laws. Moreover, applying for a special use permit is a lengthy process and it would not provide as much security as the zoning codes would (Castillo et al, 2013).

2.10.3 Poisoning of soil

Urban soil usually holds toxic substances including lead, zinc, copper, tin, mercury, and arsenic. Emissions from factories, automobiles and sewages are responsible for these harmful elements present in urban soils. Excess of these substances can lead to serious health problems for urban food consumers. The excessive use of pesticides, fertilizers, organic matter, and nitrogen can cause poisoning of the soil. The soil can become infertile and the residues in the soil can later pollute the water by leaching into the major waterways of the city. This can lead to serious health problems like dysentery, salmonella, cholera, and schistosomiasis.

2.10.4 Lack of funding

Lack of funding and policy barriers are also considered one of the main constraints for urban farmers (Arif et al., 2019). Limited cultivation space, water shortage and homeownership are the obstacles faced by on-plot farmers which leads to less or no production of home-grown fruits and vegetables. Soil quality, small plot sizes, erratic rainfall patterns and urban land use by laws are barriers of off-plot farming in Bulawayo, Zimbabwe. Land tenure security has become a major hurdle for off-plot urban farmers as public land is unpredictable and can be used for any kind of purposes in future which makes urban agriculture unstable (Mayo,2013).

3. Methodology

Aim of the research is to encourage citizens of Pakistan to adopt urban agriculture in order to ensure food security by analyzing the current situation of urban agriculture practices in Lahore. Intent of this research is to evaluate existing policies regarding urban farming and study the existing urban agriculture practices at household level with the help of indicators which drive and obstruct agricultural practices at

urban areas. Also, the focus is on determining willingness of adoption of agriculture by urban dwellers and suggesting strategies to promote urban agriculture policy-wise.

The research is mainly exploratory research. However, both qualitative and quantitative data will be considered because literature review is a main part of the research for formulating a framework for policy makers as well as numerical data will be used to assess the existing situation and willingness of people to adapt urban agriculture in Pakistan. So, mixed methods research is best suited for the research at hand as it integrates both types of data which will prove helpful to analyze the existing situation and willingness of people to practice urban agriculture as well as to formulate strategies to promote urban agriculture practices in the area.

3.1 Description of Study Area

Lahore is capital of Punjab province and second largest city of Pakistan. It lies between 31° 15' and 31° 43' North latitude, 74° 10' and 74° 39' East longitude (Shirazi, 2012). The city consists of a total area of 156 square miles (404 square kilometers). 36% of the land which is 63,800 hectares constitutes urban areas which comprises of roads and buildings of any form. It is second most populous city with population of 11,126,285 according to the census conducted in 2017. Annual growth rate of the city is 4.07 since 1998. 47.64% of the population is female while 52.35% is male and only 0.01% is transgender (Pakistan Bureau of Statistics, 2017). Lahore is facing a high migration rate from suburbs and other cities because of proportional growth of industry and economy, causing conversion of massive agricultural land into built-up urban land (Ashraf et al, 2015). So, there is a dire need to introduce urban farming among the inhabitants of the city to ensure food security in the area.

The two societies taken for data collection are Johar Town and Faisal Town, Lahore. Johar town lies near important inter-city Johar town is situated along Canal Bank Road and is divided into two phases: 1

and 2. These both phases are further feature many blocks. Phase 1 is sub-divided into A,B,C,D,E,F,G blocks whereas Phase 2 is divided into H,I,J,K,L,M,N,O,P,Q,R blocks. Residential plots in this area range from 3 Marlas to 2 Kanal. Johar town is named after Maulana Mohammad Ali Johar who was one of the most renowned Muslim leaders of South Asia. Faisal town is a relatively small society which is divided into 4 blocks: A,B,C and D. Faisal town is one of the neighboring districts of Lahore located at the south of the city center, right near the University of Punjab campus and newly planned district, Model town. It has a total of six mosques and 4 parks. One of the parks is huge and has 2 lakes. Residential plots in this society ranges from 5 marla to 1 kanal.
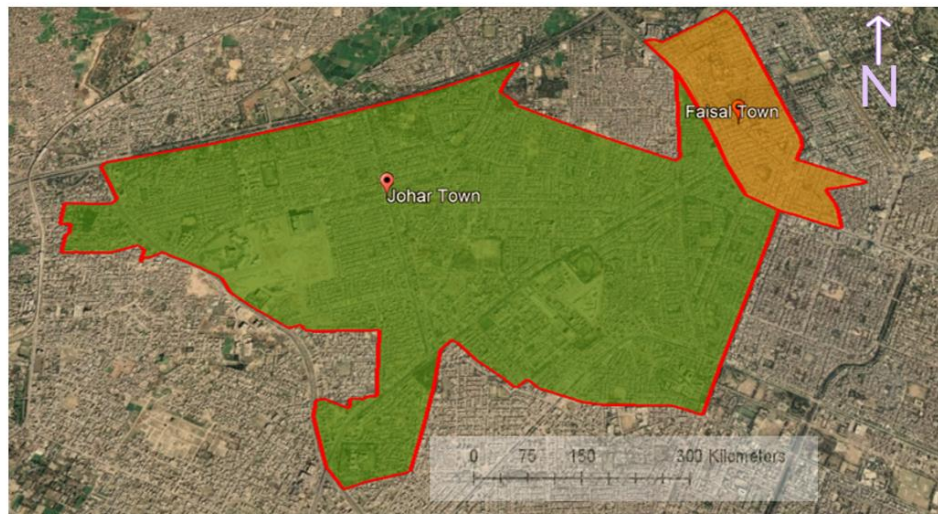
Figure 3.1 Study area featuring Johar Town and Faisal Town, Lahore

3.2 Materials

In order to assess the willingness of urban dwellers to pursue urban agriculture and evaluate the existing situation of urban agriculture practices in the area, a household level survey was conducted. A questionnaire was formulated for this very purpose. Indicators like income, water availability, soil fertility, sanitation condition, heavy metals in the air and soil, low liability on marketing, infrastructural

problems, conflicting governmental policies, unemployment, poverty, salinity, and water logging will be considered while making questionnaire. Also, with the help of literature review of published books and article, strategies will be formulated to promote urban agriculture practices in Pakistan.

3.4 Data Collection

Data assessed for this research will be based on two different sources which are as follows:

1. Primary sources of data

2. Secondary sources of data

3.4.1 Primary Source of Data

Primary data was acquired through survey of households in few areas of Lahore which may or may not practice urban agriculture to evaluate the existing situation of urban agriculture practices. It will calculate how famous urban agriculture is among the dwellers. It will also determine the willingness of urban dwellers to adapt urban agriculture in the future.

The questionnaire will be constituted on questions like 1) whether they grow vegetables at their homes 2) whether they are growing enough to meet their daily requirement 3) Whether they use their homes or adjacent areas for growing fruits and vegetables 4) Whether they have been given any advantage by the government 5) Whether men are more interested in the activity or the women are 6) How much is the cost bearing 7) Are the seeds accessible 8) How much time do they give to their gardens 9) Do they use their walls, roofs or containers to do the activity 9) Are they aware of types of urban agriculture and how they can help them even without having excess land available 10) What are the issues which act as barriers like water shortage , land availability, etc. 11) What are the reasons to engage in urban farming? Would they be interested in rain-water harvesting and recycling of wastewater for urban farming?

3.4.2 Indicators

Following indicators were used to measure social, economic, health and environmental benefits of growing food in the city. Questionnaire was made using these indicators as a reference.

Table 3.1 Thematic Areas and Indicators of Willingness of Urban Agriculture

Thematic Areas	Indicators Of Willingness	Citation
Economy	Income Enhancement	Nugent,2000;Maxwell, 2003; Maxwell et al., 1998; Armar-Klemesu, 2001; Egal et al., 2001
	Subsidies by government	Ahearn et. Al., 2006
	Home ownership	Erickson et. Al.,2011
	Supplementary Employment	
	Access to land	Nugent,2000
	high prices of food market	
	Economic Crisis	
	Income or asset diversification	
	Civil emergencies	
Health and Nutrition	Access to fresh food	Specht et. Al, 2014
	Access to pesticide free food	
Food security	Child Nutrition	Maxwell et. Al., 1998
	Inaccessibility to food	Nugent,2000
Climate Change	Weather or Macro-economic Upheaval	Nugent,2000
Social Wellbeing	Community social life	Rehman et. Al., 2003
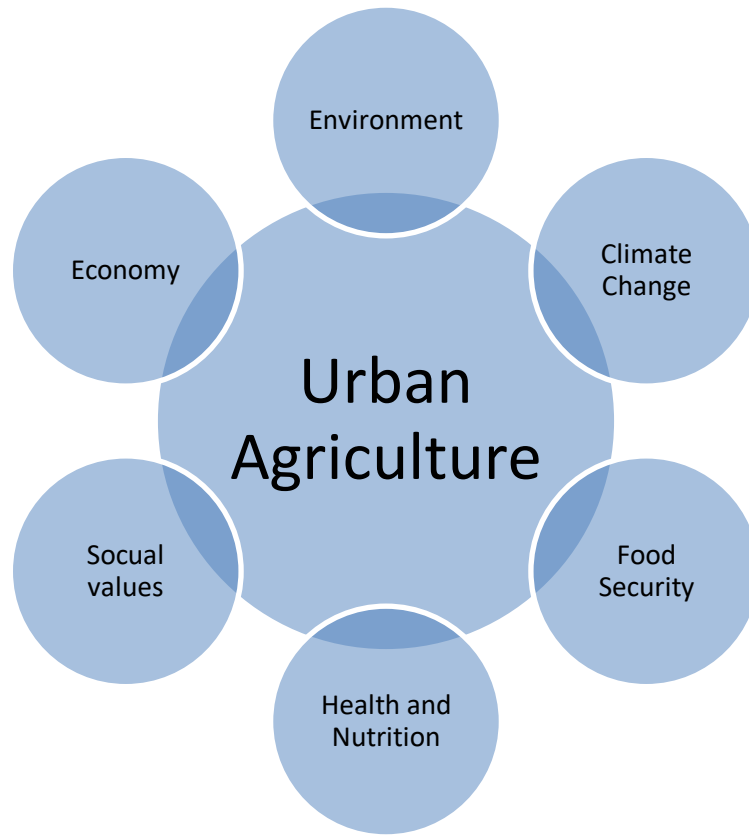
Figure 3.2 Urban Agriculture and its thematic areas

Figure 3.3 Indicators of Willingness of Urban Agriculture

3.4.2 Secondary Source of Data

First part of this research focuses on the policies of urban agriculture. It studies all the policies made in the world to promote urban agriculture and will help make policies to promote urban agriculture in Pakistan as well. So, basically secondary data is obtained through literature review of published surveys, books and articles. This data will be used to perform content policy analysis and evaluate the existing conditions of urban agriculture throughout the world. Specific tables and charts taken from online sources are listed in Table 3 2.

Table 3.2 Secondary data types with sources

Data Type	Source
Urbanization prospects of the world	UN report 2004; UN report 2018
Population growth of Pakistan	Pakistan Bureau of Statistics / Tradeeconomics.com
Food insecurity data of Pakistan	National Nutrition Survey of 2018 conducted by Ministry of Health and UNESCO

3.5 Household Survey

Two samples of households will be selected which may or may not be engaged in urban farming. A measuring formula named " Solvin formula" was used to calculate sample size which is "n= N/ $(1+Ne^2)$" where n= sample size, N=Population of the community, e= Margin of error. The sample size of the survey was taken as 140 households.

The tool used to obtain primary data is a questionnaire which revolves around specific indicators like "income, household size, willingness, time, advantages or subsidies given by government, accessibility of seeds of plants mainly food, water availability, accessibility to market, among others"

3.6 Data analysis and Processing

Quantitative data obtained through household survey will be digitized in Microsoft Excel and SPSS. This data will be analyzed using linear regression, ANOVA and other descriptive statistics will also be applied on the data including mean, median, mode and various other techniques. Data analysis along with literature review will help create strategies to promote urban agriculture. These strategies will be correlated with existing policies at the end of the study.

3.7 Policy Content Analysis

Policy content analysis was performed through literature review which helped identify drivers and barriers of urban agriculture throughout the world. Literature review will mainly focus on best practices of urban farming throughout the world. This will help formulate a framework of strategies to promote urban agriculture in Pakistan. Literature review will create better understanding of urban agriculture for the experts so that they can implement the strategies used by other countries in Pakistan. It will help make policies which will support and uphold urban farming in the country. It will make the understanding of both drivers and barriers easy for the experts so that they can overcome the risks and use drivers at their best to promote urban agriculture in the area.

3.8 Strategic Recommendations

Strategies are formulated at the end of the study which will be recommended to be incorporated in policies of related organizations. These strategies would be inferred from best practices of urban farming in the world obtained through literature review, drivers and barriers obtained from primary data of

household survey. These strategies were formulated after complete analysis of ways and models used in the world from time to time to promote urban agriculture while keeping in mind the existing conditions and problems of the urban dwellers of the study area.

3.9 Flow Chart
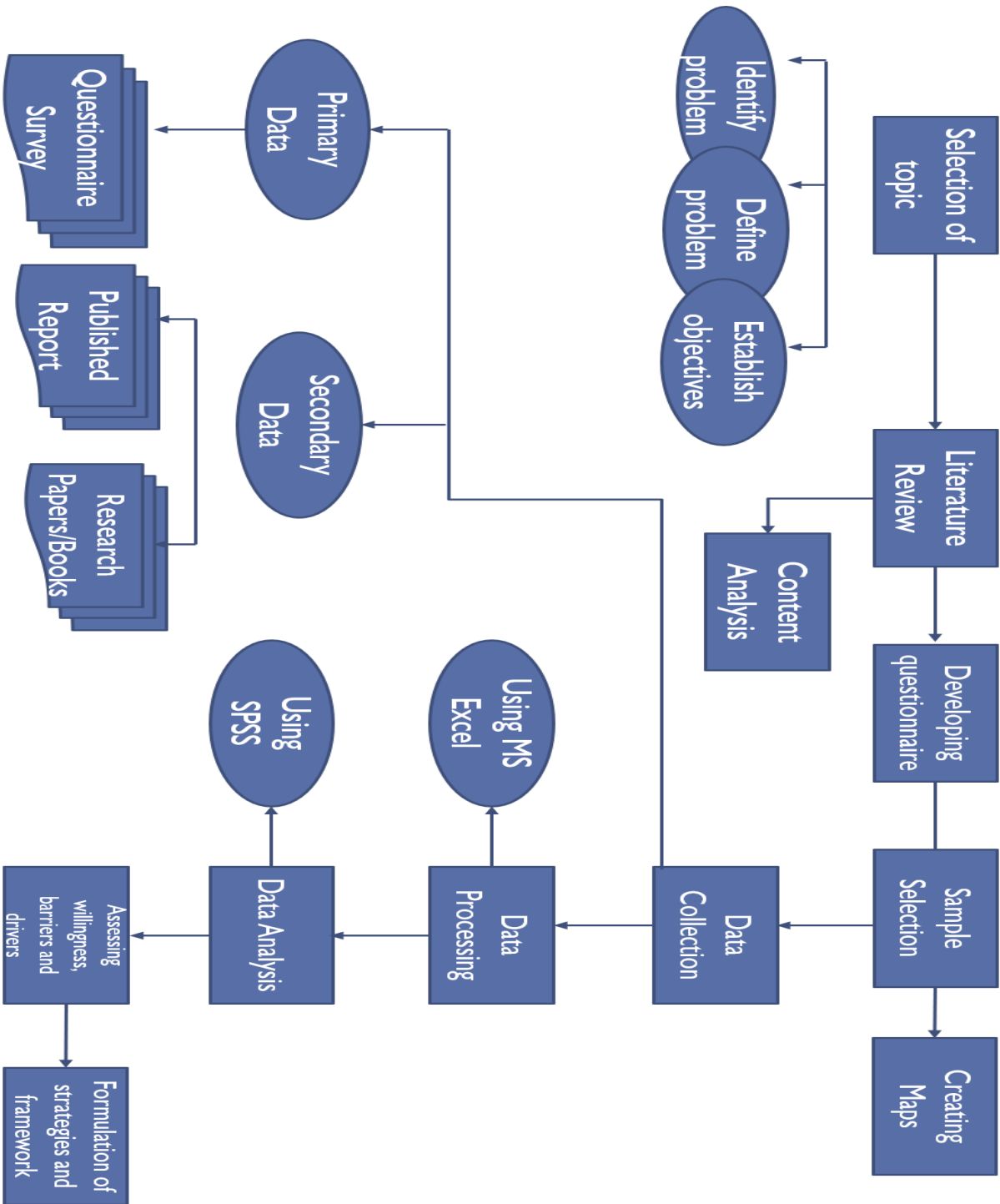
Figure 3.4 Flow Chart of Methodology

4. Results and Findings of Household Survey

4.1 Socio-Economic Profile of Respondents

The data is collected from areas of Lahore where most of the houses are small and there are fewer big houses. Plot sizes range from 3 marlas to 2 kanal. The respondents belong to both genders with ages ranging from 20 to 50 years. The respondents belonged to a variety of fields shown in Table 4.1. Most of the respondents of the survey are undergraduates. Majority of the respondents were living in rented houses for jobs because of high market prices of the land. Maximum number of the respondents are living in these houses for 1-9 years. Monthly income of my respondents ranges from 35,000 PKR to 4 lac per month, so that response of all economic classes could be analyzed properly.

Table 4.1 Socio-Economic Profile of Respondents

Respondent's profile	Category	Frequency	Percentage

Gender	Male	61	44%
	Female	79	56%
Age	Less than 20	44	1%
	20-24	59	24%
	25-29	8	71%
	30-34	27	28%
	35-39	6	7%
	40 and above	44	11%
Field of work	Civil Engineering	18	13%
	Software engineering and computer science	6	4%
	Urban planning	14	10%
	Architecture	8	6%
	Business and management	6	4%
	IT and telecommunication	8	6%
	Medical	22	16%
	Teaching	11	8%
	Fine arts and fashion designing	4	3%
	Research	1	0.70%
	Student	7	5%
	None	33	24%
Years of Education	Intermediate	19	14%
	Undergraduates	69	49%
	Postgraduates	52	37%
Monthly income in PKR	Less than 50000	8	6%
	50000 to 95000	42	30%
	100000 to 145000	41	29%
	150000 to 195000	14	9%
	200000 to 250000	21	15%
	> 250000	15	11%

Table 4.2 Living Situation of the Respondents

Respondent's Profile	Category	Frequency	Percentage
House ownership	Rented	83	58.00%
	Homeowners	58	41.00%
Living since	>1 year	4	3%
	1 -4 years	41	30%
	5-9 years	41	30%
	5-9 years	30	22%
	10-14 years	14	6%
Household members	1-5 members	62	45%
	6-10 members	73	53%
	>10 members	3	2%
Household area	0-5 Marlas	44	31%
	6-10 Marlas	53	38%
	11-15 Marlas	8	6%
	16-20 Marlas	27	19%
	>20 Marlas	8	6%

4.2 Eating habits of Urban Dwellers

67% of the respondents were eating enough fruit, 64% were eating enough vegetables and 77% were eating enough meat and dairy products whereas 78% were eating home cooked food. On average, 66% were eating healthy and meeting all their nutritional requirements. 75% of the urban residents would like to eat organic fruits and vegetables and 87% wanted to eat organic eggs daily. 95% think that fresh food is nutritious, and it was one of the biggest driving factors found among the urban dwellers. Only 6% were selling some kind of fruit and 4% were selling some vegetables grown at home.
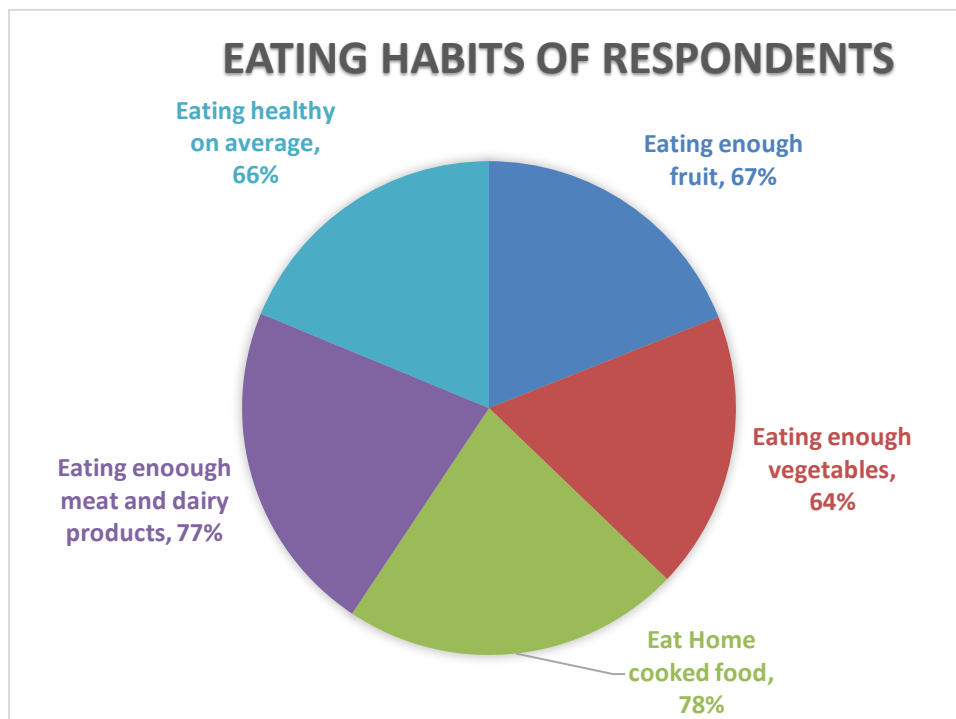
Figure 4.1 Eating Habits of Respondents

89% of the respondents ate home cooked food. 35% of the urban dwellers cooked twice a day and 83% cooked once a day while only 1% did not cook at all. The most used ingredients were onion, tomatoes, flour, garlic, ginger, green chilies, coriander, and mint. 58% of the respondents think they can plant these ingredients at home while 20% are not sure and 22% think they cannot plant these ingredients at their homes.

4.3 Urban Agriculture and Self-sufficiency

Self-sufficiency or self-reliance in food was measured using more than two variables which identified whether people were producing enough fruit and vegetables to meet their daily requirements. The major trend found in Lahore was that people would rather buy food items from market than plant it at home. So, most of the population of the survey was found not to be self-sufficient in food. Only 24% were

growing enough fruits that could meet their daily requirements and 30% were growing enough

vegetables that would usually meet their daily consumption needs. By computing means of both

variables, we found out the self-sufficiency of the respondents which was only 27%. We have not taken

meat and dairy into account for this particular analysis. Following table shows our findings.

Table 4.3 Self-sufficiency of respondents in food

Variable	Minimum	Maximum	Mean	S.E	Percentage
Growing fruits meeting daily requirements	1	3	1.2	0.089	24%
Growing Vegetables meeting daily requirement	1	4	1.5	0.076	30%
Self-sufficiency	1	3	1.35	0.049	27%

However, if urban agriculture is practiced in cities of Pakistan, it can easily become self-sufficient in

food products. On top of that, high prices of food would no longer increase poverty ratios in the country.

4.4 Urban Agriculture and Food Insecurity

With increasing population, food insecurity has become a major issue in the developing world. A

thorough and complete definition of food security as stated by United Nations is "A household is food

secure when it has access to food needed for a healthy life for all its members and when it is not undue

risk of losing such access" . A household is food insecure if food availability is an issue for a long

period of time. In this study, food security is computed using mean of three variables which tell us

whether the respondents are having enough food items to consume. Three variables were consumption

of fruits, vegetables, meat and dairy. Consumption of meat and dairy was considered as one variable in

this case.

Table 4.4 Food security measured by consumption of food

Variable	Minimum	Maximum	Mean	S.E	Percentage
Consumption of Fruits	2	5	3.34	0.079	66.8%
Consumption of Vegetables	1	5	3.20	0.083	64%
Consumptions of Meat and Dairy	2	5	3.86	0.063	77.2%
Food Security	2	5	3.46	0.054	69.2%

4.5 Drivers of Urban Agriculture

Upon asking the respondents, we came to know various factors which motivates them to engage in urban agriculture which were self-reliance, high prices in food market, lack of nutritious food available, health concerns, mental well-being, love for gardening, finding a healthy hobby, aesthetics, natural beauty, fresh air, spending time with nature, religious obligations, reducing climate change impact and enhancing household's income by selling the produce. 80% of the women were motivated by self-reliance in food while 74% of men were encouraged to do urban farming for the same reason. 70% of men and 80% of women were motivated due to high price of food in the market. 75% of men were motivated due to non-availability of fresh food whereas 79% of women were also encouraged to engage in urban farming for the same reason. 81% of men and 90% of women wanted to grow fruits and vegetables at home because they had health concerns. 85% of men and 92% of women were interested

in urban farming because of their mental well-being. 79% of men and 85% of women were more willing to persuade farming at home because of their love for gardening. 80% of men and 70% of women wanted to engage themselves in a healthy hobby. 80% of men and 85% of women wanted to plant trees as it is one of religious obligations of Islam. Most of the respondents belong to Muslim community. 50% of men and 60% wanted to increase their livelihood by selling home-grown fruits and vegetables.

Table 4.5 Drivers/Motivators of Urban Agriculture

Drivers of Urban Agriculture	Percentage
Love for gardening	60%
Health concerns	100%
Lack of nutritious food	80%
Non-availability of fresh food	100%
High prices of food	89%
Self-reliance in food	60%
Mental well-being	80%
Finding a healthy hobby	40%
Enhancing household's income by selling the produce	40%
Religious duty	83%
Reduce climate change impact	60%
Fresh air	80%
Aesthetics	80%
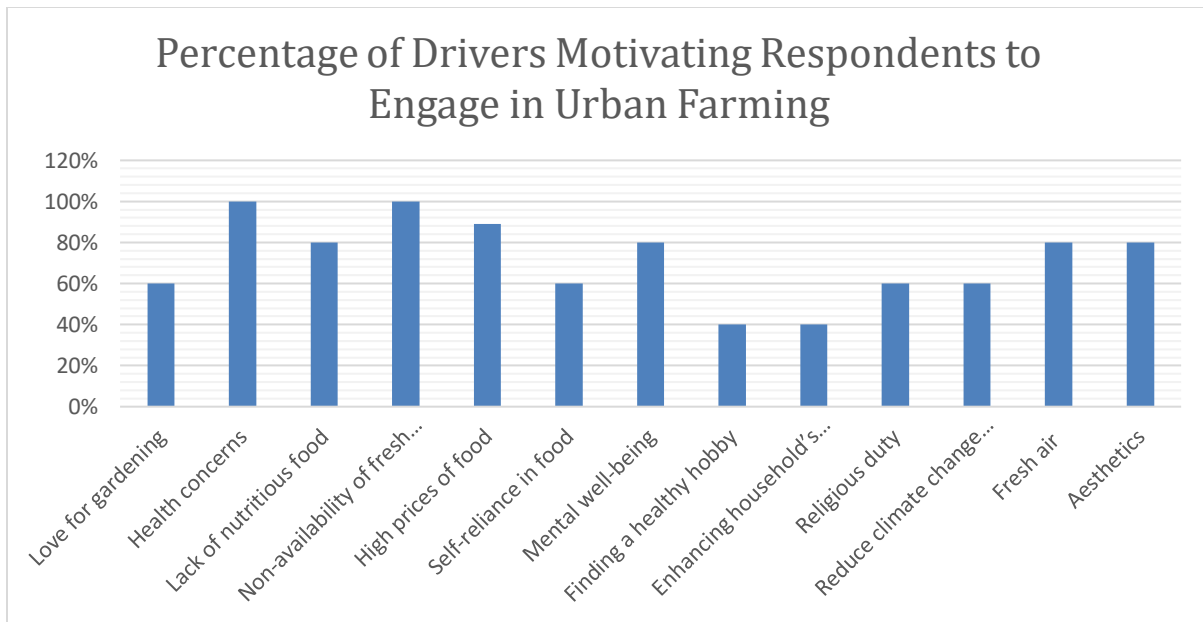
Figure 4 2 Percentage of Drivers Motivating Respondents to Engage in Urban Farming

4.5 Barriers of Urban Agriculture

The barriers which were hindering the urban dwellers to engage in urban agriculture practices were access to land, lack of time availability, lack of interest, increase in mosquitos and other insects, lack of guidance and training, lack of finances, water availability and soil fertility. Most of the people living in slums and rental houses, do not have access to land available which makes it difficult for them to engage in urban farming activities. There is no guidance or almost no professional trainings available which could help people grow their own food items. Although now internet has taken over and anyone who wants to learn gardening can easily learn through online workshops and videos. People also fear that if they start growing plants everywhere like on their walls and roof, their houses might be too much contaminated with insects. Respondents don't want too many mosquitos at their homes mostly because of the fear of dengue fever. Time availability is also one of the major factor hindering urban dwellers to do urban gardening as life has become so fast and with 9-5 office timings which extend to 7-8pm off timings due to long distances, it becomes difficult for working people to focus on gardening. Hence,

instead of planting anything on their own and taking care of the plants, they just go to a nearby market and buy all the necessary food items.

Table 4.6 Barriers of Urban Agriculture

Barriers of Urban Agriculture	Percentage
Availability of land	80%
Laziness and procrastination	60%
Time Availability	80%
Water Availability	20%
Soil fertility	20%
Lack of interest	40%
Finances	60%
Increase in Mosquitos and other insects	70%
Lack of guidance	60%
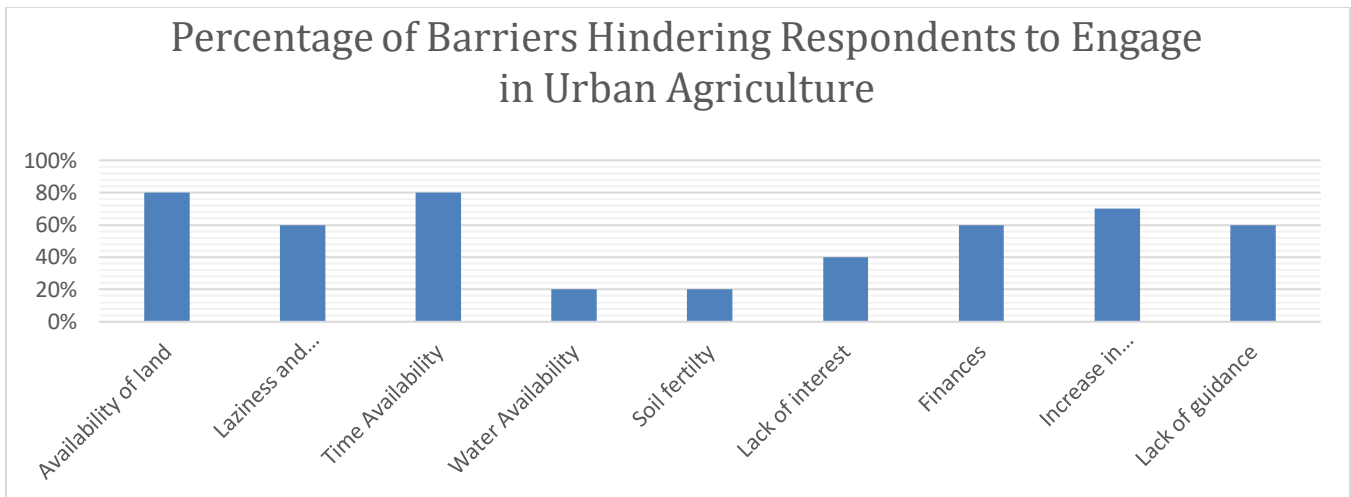
Figure 4.3 Percentage of Barriers Hindering Respondents to Engage in Urban Agriculture

4.6 Environment, Stress and Urban Agriculture

The respondents think that growing food at home would decrease food miles 80% of the times and hence, it would benefit the environment and contribute towards combating climate change. 47% of the respondents were found stressed. The respondents think that gardening helps reduce their stress levels 67% of the times. 60% of the residents think that gardening could improve their health. 82% of the urban dwellers were willing to interact with fellow gardeners if they opt community gardening in the future. 70% of the urban dwellers think that water availability will not be an issue and 62% think that the water of their household is not contaminated. 85% think that it would not increase water or electricity bills.

4.7 Willingness of Respondents to do Urban Farming

Willingness of respondents to engage in urban agriculture was computed using four variables. Most of the respondents were found somewhat willing to do food gardening. Willingness was plotted against age, income, field of work, household size, household area, house ownership and the following results were found. Respondents belonging to age group 20-29 years and above 40 years were found to be

extremely willing to engage in urban farming whereas 30-34 years age group was very willing, and 35-39 years were somewhat willing. Residents with 1-10 household members were extremely willing whereas more than 10 members household were very willing to practice urban agriculture. People who were living in their own house were extremely interested in urban farming whereas those living in rented houses were also very interested provided they had access to land. There was no evident difference in people's interest and willingness with respect to the income groups they belong. Low income groups wanted to increase their livelihood by planting and selling food, middle income groups wanted to save money by not spending on food and higher income groups mostly wanted to eat nutritional food and save money. 77% of the respondents were willing to be trained by professionals and 70% were willing to pay for training. 60% would let their women to be trained by professionals. 47% of the urban dwellers had two days off , 21% had only one off-day whereas 27% had none who were not working at the moment. 58% of the respondents were willing to spend their off days on food gardening while 42% had other activities planned or simply wanted to rest for the weekend.

The respondents were asked questions about their willingness to adopt urban agriculture. They were asked questions whether they would engage in urban farming if financial assistance was provided to them. The variable index of willingness was made in SPSS and was divided into the higher, moderate, and lower levels.

Table 4.7 Willingness Index Variable of Urban Agriculture

Willingness index variables	Range	Percentage
Low	1.01-2.51	22%
Moderate	2.52-3.65	38%

High	3.66-5.0	40%

4.8 Awareness of Urban Agriculture

To evaluate the awareness level of the respondents of both societies about urban agriculture, different questions were asked. The variable index was divided into the higher, moderate, and lower levels. Lower awareness meant that the individual had almost zero knowledge about concept of urban agriculture, its forms and how it could benefit them as an alternative survival strategy. Moderate awareness meant that the individual gave a mild response. High awareness meant a complete awareness.

Table 4.8 Awareness Index Variable of Urban Agriculture

Awareness index variables	Range	Percentage
Low	1.10-2.50	32%
Moderate	2.51-3.62	43%
High	3.63-4.33	20%

Overall, 59% of the respondents were aware about the types of urban agriculture like micro-farming in and around the house, community gardening, vertical farming, rooftop gardening, backyard gardening, animal husbandry, urban beekeeping. 60% of the respondents knew about the kinds of plant that grow in different seasons of the year. 40% of the people were familiar with ways a crop is planted. 80% knew where to get the seeds from. 35% of the respondents were interested in food gardening, 39% were interested in both, 20% were interested in both and 6% were interested in none. Only 20% of the respondents are willing to farm on walls and rooftops. Most of them worry about seepage issue and

strength of their rooftops.99% of the respondents are not growing enough fruits and vegetables at home to sell.

4.8 Urban Farming and Water Availability

Water is an essential requirement for farming whether it is carried out in rural areas or urban areas. But unfortunately, water consumption has increased over the years in comparison to its availability. To do urban farming sustainably, we need to think of smart ways to utilize water. So, for this purpose, reuse and recycling of wastewater is important. The increase in demand of water for irrigation has produced a discernible rise in the reuse of treated or untreated wastewater throughout the world. Industrial or municipal wastewater use in agriculture is a usual practice in many parts of the world (Blumenthal et al., 2000; Ensink et al., 2002; WHO, 2006; Sharma et al., 2007). Rough estimates indicate that at least twenty million hectares in 50 countries are irrigated with raw or partially treated wastewater (Scott et al., 2004; Hussain et al., 2001)

60% of respondents think that water availability would not be an issue for food gardening. 60% would use water supply for irrigation, 30% were not sure and 22% were not going to use it. 67% were willing to invest in rainwater harvesting at their homes while 16% were somewhat interested and 15% did not want to do anything with it. 27% were willing to use recycled water for their produce while 58% were not sure. Although 14% did not want to use recycled water for irrigation purposes. 34% were interested in installing a recycling plant at their homes for watering the plants whereas 29% were not sure and 28% did not want to install a recycling plant at their home due to various reasons. The reasons were installation costs, maintenance cost and its life which according to public is not very long.

The growing demand of water for irrigation has produced a marked increase in the reuse of treated and/or untreated wastewater worldwide.

4.9 Urban Farming and Affordability

80% of the people can afford to buy gardening equipment and 75% could afford the plantation cost. 90% think that seeds are affordable and 60% can afford to buy full grown plants. On a scale of 1 to 5, most of the people think that the cost associated with farming fruits and vegetables ranks at 2. 30% think that growing fruits and vegetables would increase their household income and others think it would just help them save some money. Affordability of the respondents was computed using 4 variables which was later recoded into affordability index. The index was divided into three ranges: low, medium and slightly high.

Table 4.9 Affordability index variable of Urban Agriculture

Affordability index variable	Range	Percentage
Low	.1-1.5	50%
Medium	1.51-2.0	29%
Slightly High	2.01-5	21%

4.10 Participation of Women, Kids and Elderly

71% respondents think that it is highly likely that females of their household might get involved in urban farming, while 17% are not sure and 12% think that it is very unlikely that they'll get engaged in urban agriculture somehow. 67% of the respondents said that they would let their women work in a community garden while 18% weren't sure and 15% think that it is highly unlikely that women of their household will work in a community garden.74% of the respondents think that it is likely that old people

of their household would benefit from community gardening, 19% aren't sure and 33% think that it's really unlikely for them to go out in this old age. 61% of the urban dwellers said that they would allow their kids to plant fruits and vegetables in a nearby community garden, 26% weren't sure and 34% said that its highly unlikely that they would let their kids go to a nearby garden without their supervision.

4.11 Urban Agriculture and Covid-19

In the correlation matrix, if a person is jobless due to the covid-19 lockdown, he has more spare time, but he is not still willing to spend the time on healthy and productive activity like growing food. The reason of this situation is that people are frustrated and don't want to spend their left over money on a risky business like urban farming as no one is sure if their food would grow out perfectly due to lack of awareness and training in this area. Moreover, most of the people do not want to spend money in the situation like this as they are already making their ends meet difficultly.

Table 4.10 Correlation Matrix of Variables of Impact of Covid-19 on Urban Agriculture

	Joblessness due to Covid-19	Spare time due to covid-19	Willingness to spend time in a healthy and productive activity	Willingness to grow food because of the free time
Joblessness	1.000	.808	.197	.088
Spare time	.808	1.000	.109	.073
Willingness to spend time in a healthy and productive activity	.197	.109	1.000	.667
Willingness to grow food because of free time	.088	.073	.667	1.000

18% of people are jobless now a days because of covid-19 lockdown. 26% are working from home. So, most of the people have extra time to spend on urban food gardening. 36% of the respondents had spare time due to covid-19 pandemic as people have lost jobs and also they cannot move as freely as they used to before the pandemic began. 66% wanted to spend their spare time in doing a healthy and productive activity. 61% think that buy food from food vendors is risky in this situation and 39% think that it is not at all risky but convenient. 78% wanted to grow food because of all the free time they got in this pandemic.

With covid-19, there is a massive decrease in wages throughout Pakistan. Most of the people have gone jobless especially due to the pandemic. It was reported in a study by Hussain(2020) that there are almost 5 million people in Pakistan who live just at or below the subsistence line and there are tons of unqualified people for instance waste recyclers, construction workers, labors and domestic workers who reply on daily wages to meet their needs. Around 4 million people are working on daily wages in Karachi alone, and it is estimated that almost 4 million belong to daily wagers group in Punjab. Then there are small and medium enterprises such as textile and apparel industry were badly affected due to imposition of lockdown. Agricultural sector is no exception when being hit by covid-19 is being discussed. For example, wheat harvesting usually began in late March until mid of June in Sindh and Punjab, but due to non-availability of labor and transport, this sector had to face numerous problems. Same is the case with the transport sector, most of the drivers of local transport, taxi, rickshaw have been out of jobs since the pandemic entered the country (Worldbank,2020b).

4.12 Reliability Analysis

Initially, there were 12 factors called as motivators but after conducting reliability test, only 5 items' data is found to be significant. The value of Cronbach's Alpha for motivator is 60.8%. For affordability,

there was 6 but 4 are found reliable after the reliability test. For awareness and impact of covid-19, all the items were found reliable. Whereas for barriers, initially there were 9 but 8 are used. All items of the variable "Willingness" were found to be reliable according to its Cronbach alpha value.

Table 4.11 Reliability Analysis of Variables

Variables	Cronbach's Alpha	No. of items
Motivators	0.608	5
Interest/Willingness	0.759	3
Awareness	0.743	5
Affordability	0.710	4
Covid-19	0.651	4
Barriers	0.623	8

4.13 Linear Regression Analysis

Using linear regression analysis, we are going to determine if knowledge is a good enough variable to predict willingness of respondents to do urban agriculture. The equation used is

$Willingness = \beta o + \beta 1(awarerness) + \epsilon$. Willingness is the dependent variable whereas awareness is an independent variable. βo and $\beta 1$ are coefficients determined using liner regression analysis in SPSS while ϵ stands for standard errors. The F-test of overall significance is conducted to evaluate either your linear regression model provides a better fit to the data than a model that contains no independent variables or not.

In Table 4.12, the significance of impact of awareness on willingness is 0.0009. Although the value is extremely small but being less than 5% indicates that the determinant is significant. 4.9% of the variance in willingness of the respondents can be explained by awareness of the respondents about urban agriculture. The value is low because awareness of the respondents about urban agriculture and its various techniques is also considerably low. So, it is required to make the public more aware about the techniques of urban farming, how much would it cost and its benefits.

Table 4.12 Linear Regression Analysis of Willingness and Awareness of respondents

Variables	Model Summary			Coefficients	
	Estimate	**F change**	**Sign F. Change**	**B coefficient**	**Standard Error**
Awareness	0.049	7.127	0.009	0.249	0.276

After adding, affordability to the equation, the equation becomes

$$Willingness = \beta o + \beta 1(awarerness) + \beta 2(Affordability) + \epsilon.$$

Linear regression will determine whether awareness and affordability both have a significant impact on willingness of the respondents to engage in urban agriculture practices. For this purpose, willingness is kept dependent variable whereas awareness and affordability are independent variables. The value of the estimate has increased but significance is still very low. We will report the model significance as $F(2,137)=4.904, p=0.0001$. Moreover, 13.2 % of the variance in willingness can be explained by awareness and affordability together. Our equation based on the values obtained from SPSS becomes

$$Willingness = 2.082 + .228(awarerness) + .341(Affordability) + \epsilon.$$

Table 4.13 Linear regression analysis of Willingness, Awareness and Affordability

Variables	Model Summary	Coefficients

	Estimate	F change	Sign F. Change	B coefficient	Standard Error
Awareness	0.132	10.278	0.0001	0.228	0.091
Affordability				0.341	0.106

Now, we have applied the same analysis on three variables which are awareness, affordability, and motivators of urban agriculture. The significance of the model is reported as $F(3,134)=32.43; p=.000$ 42.1% of the variability in willingness can be described by awareness, affordability, and motivators together. The value of significance is less than 0.05, hence the null hypothesis is disqualified and there is absolutely a significant relationship between the three variables and willingness of the respondents. As it is evident that motivators have a huge impact on the model as the willingness of the respondents can be described by them. After adding, motivators to the equation, the equation becomes

$$Willingness = .421 + .134(awarerness) + .194(Affordability) + .609(Motivators) + Є.$$

Table 4.14 Linear regression analysis of Willingness, awareness, affordability, and motivators of urban agriculture

Variables	Model Summary			Coefficients	
	Estimate	F change	Sign F. Change	B coefficient	Standard Error
Awareness				0.134	.075
Affordability	.421	32.431	.000	0.194	.089
Motivators				0.609	.075

After adding impact of covid-19, 40.7% of the variability in the dataset of willingness can be explained by awareness, affordability, motivators, and covid-19. Whereas the significance of the model can be explained by the equation : $F(4,133)=24.406; p= 3.696 \times 10^{-14}$. The value of significance is very low, but it still depicts that the model is significant, and all these variables have a direct impact on willingness of the respondents. After adding covid-19 to the model, the equation becomes

$$Willingness = .398 + .135(awareness) + .193(Affordability) + .605(Motivators) +$$
$$.055(Covid - 19) + \epsilon.$$

Table 4.15 Linear regression analysis of Willingness, Awareness, Affordability, Motivators and Covid-19

Variables	Model Summary			Coefficients	
	Estimate	**F change**	**Sign F. Change**	**B coefficient**	**Standard Error**
Awareness				.135	.093
Affordability	.423	24.406	.000	.193	.106
Motivators				.605	.081
Covid-19				.055	.085

Although, if we add covid-19 before adding motivators to the model, our estimates are increased by 1%. The significance of the model would have been defined as $F(4,133)=7.287; p=.0000$. The equation would have been:

$$Willingness = 1.898 + .229(Awareness) + .339(Affordability) + .096(Covid) + \epsilon$$

Although the β coefficients are not significant. So, we would not use this model.

Table 4.16 Linear regression analysis of Willingness, awareness, affordability, and covid-19

Variables	Model Summary			Coefficients	
	Estimate	F change	Sign F. Change	β coefficient	Standard Error
Awareness		7.287	.0000145	.229	.091
Affordability	.140			.339	.106
Covid-19				.096	.085

After addition of the variable "time spent in the house", the value of R square(estimate) has increased considerably. Now, 50.8% of the variance in the dataset of willingness can be describe by the variables in the table 4 17. The significance of the model will be stated in equation as $F(5,132)=27.252, p=.000$. So, time spent in the household is a variable which is determining willingness of respondents to do urban farming a great deal. Our equation becomes:

$$Willingness = .279 + .06(Awareness) + .064(Affordability) + .221(Motivators)$$
$$+ .540(Covid) + .170(Time\ spent\ in\ the\ house) + \epsilon$$

Table 4.17 Linear regression analysis of Willingness, awareness, affordability,motivators,covid-19 and time spent in the house

Variables	Model Summary			Coefficients	
	Estimate	F change	Sign F. Change	B coefficient	Standard Error
Awareness	.508	27.252	.000	.064	.072
Affordability				.221	.083
Motivators				.540	.071
Covid-19				.031	.065

After addition of income, the R square value becomes 51.4% which is a very minimal increase as compared to our last result. Income has very little impact on the variability of the dataset of willingness. It means that regardless of the income being very high or very low, people are interested to do urban farming. The significance of this model will be stated as $F(6,131)=23.075; p=.000$. Our equation becomes:

$$Willingness = .248 + .095(Awareness) + .238(Affordability) + .511(Motivators)$$
$$+ .010(Covid) + .095(Time\ spent\ in\ the\ house) + .094(Income) + \epsilon$$

Table 4.18 Linear regression analysis of Willingness, awareness, affordability,motivators,covid-19, time spent in the house and income

Variables	Model Summary			Coefficients	
	Estimate	F change	Sign F. Change	B coefficient	Standard Error
Awareness				.069	.071
Affordability				.226	.083
Motivators				.544	.071
Covid-19	.514	23.075	.000	.027	.065
Time spent in the house				.118	.054
Income				.061	.048

Adding household members, changed the R square value to .514 which means that household members has made a little difference in the predictability of willingness. So , it is inferred that respondents were interested in urban farming no matter how many the household members were. All these variables together are predicting 51.4% of the willingness of the respondents. The significance of the model is $F_{(7,130)}=19.640; p=.0003$. Our equation becomes:

$$Willingness = .207 + .071(Awareness) + ..226(Affordability) + .542(Motivators)$$

$$+ .028(Covid) + .118(Time\ spent\ in\ the\ house) + .060(Income)$$

$$+ .030(Household\ Members) + \epsilon$$

Table 4.19 Linear regression analysis of Willingness, awareness, affordability,motivators,covid-19, time spent in the house, income, and household members

Variables	Model Summary			Coefficients	
	Estimate	**F change**	**Sign F. Change**	**B coefficient**	**Standard Error**
Awareness	.423	24.406	.000	.071	.072
Affordability				.226	.083
Motivators				.542	.072
Covid-19				.028	.066
Time spent in the house				.118	.054
Income				.060	.049
Household Members				.12	.060

Regardless of the areas of the households, respondents are willing to engage in urban agriculture. R square value has remained same by adding household area to our model. Hence, the effect of this variable is very minimal. Both respondents with large households and small households want to engage themselves in urban agriculture so that they can save some money by planting fruits and vegetables. Our equation becomes:

$$Willingness = .187 + .072(Awareness) + .228(Affordability) + .540(Motivators)$$
$$+ .030(Covid) + .120(Time\ spent\ in\ the\ house) + .057(income)$$
$$+ .012(Household\ Members + .009(Household\ Area) + \varepsilon$$

Table 4.20 Linear regression analysis of Willingness, awareness, affordability,motivators,covid-19, time spent in the house, income, household members and household area

Variables	Model Summary			Coefficients	
	Estimate	F change	Sign F. Change	B coefficient	Standard Error
Awareness	.514	17.066	.000	.072	.073
Affordability				.228	.084
Motivators				.540	.072
Covid-19				.030	.066
Time Spend in the house				.120	.055
Income				.057	.051
Household Members				.012	.061
Household Area				.009	.040

An estimate of 51.8% depicts that age also does not have much impact on the willingness of the respondents to engage in urban farming. As the age group of the respondents is not very diverse, and the lower age group "1" consist of people aged from 20-24 years and age group "2" ranges from 25-30 years. These two groups are interested in urban agriculture along with the higher age groups (40+ years), hence making not a very significant impact on the model. The significance of the model will be described as $F(9,128)=15.281; p=.000$. Our equation becomes :

$$Willingness = +.126(Awareness) + .358(Affordability) + .056(Motivators) + .074(Covid)$$

$$+ .207(Time) + .009(income) + .095(Household\ Members)$$

$$+ .037(Household\ Area) + .41(Age) + \epsilon$$

Table 4.21 Linear regression analysis of Willingness, awareness, affordability,motivators,covid-19,time spent in the house, income, household members, household area and age

Variables	Model Summary			Coefficients	
	Estimate	F change	Sign F. Change	B coefficient	Standard Error
Awareness	.518	15.281	.000	.072	.073
Affordability				.227	.084
Motivators				.541	.072
Covid-19				.038	.067
Time Spend in the house				.134	.057
Income				.045	.052

Household Members				.013	.061
Household Area				.006	.040
Age				.041	.041

After adding interest of the individuals in urban agriculture, the value of our estimate reaches .802 which shows that interest has made the most significant impact on the model. Hence, interest describes the willingness of the respondents the most. $F(10,127)= 13.732; p=.000$. Our new equation is:

$$Willingness = -.479 + .106(Awareness) + .064(Affordability) + .121(Motivators)$$
$$+ .087(Covid) + .013(Time\ spent\ in\ the\ house) + .033(income)$$
$$- .10(Household\ Members) + .017(Household\ Area) - .004(Age)$$
$$+ .810(Interest) + \varepsilon$$

This equation concludes that Household members and age of the respondents have inverse relationship with the willingness to do urban farming. As the age and household members increase, willingness of the respondent of this study decreases. All other factors have positive impact.

Table 4 22 Linear regression analysis of Willingness, awareness, affordability,motivators,covid-19,time spent in the house, income, household members, household area, age and interest

Variables	Model Summary			Coefficients	
	Estimate	**F change**	**Sign F. Change**	**B coefficient**	**Standard Error**
Awareness	.802	51.374	.000	.106	.047
Affordability				.064	.055
Motivators				.121	.056

Variables				B coefficient	Standard Error
Covid-19				.087	.043
Time Spend in the house				.013	.038
Income				.033	.034
Household Members				-.10	.039
Household Area				.017	.026
Age				-.004	.026
Interest				.810	.060

Barriers also have negative impact on the willingness of the respondents since barriers are doing nothing but hindering respondents from adopting urban agriculture. The significance of the model is defined as $F(11,128)=46.724; p=.000$. Our final equation becomes:

$$Willingness = -.342 + .102(Awareness) + .061(Affordability) + .115(Motivators)$$
$$+ .087(Covid) + .010(Time\ spent\ in\ the\ house) + .034(income)$$
$$- .009(Household\ Members) + .019(Household\ Area) - .007(Age)$$
$$+ .818(Interest) - .083(Barriers) + \epsilon$$

Table 4.23 Linear regression analysis of Willingness, awareness, affordability,motivators,covid-19,time spent in the house, income, household members, household area, age, interest and barriers

Variables	Model Summary			Coefficients	
	Estimate	**F change**	**Sign F. Change**	**B coefficient**	**Standard Error**
Awareness	.803	46.724	.000	.102	.047

Affordability	.061	.055
Motivators	.115	.056
Covid-19	.087	.043
Time Spend in the house	.010	.038
Income	.034	.034
Household Members	-.009	.039
Household Area	.019	.026
Age	-.007	.027
Interest	.818	.061
Barriers	-.083	.091

5. Conclusions and Recommendations

5.1 Conclusions

Urban farming is often considered as an alternative source of income in times of hardships and war. In our case, our country Pakistan is facing serious economic problem. The need of the time is that households of Pakistan will have to change their survival strategy and engage themselves in alternative income producing activities. Urban Agriculture is one of the time-proven strategy to increase household income in hours of need. Urban agriculture is still a new concept in Pakistan and very few people are utilizing this strategy to increase their incomes. Urban horticulture is given preference in Pakistan but it

is lacking in policies related to urban agriculture. Urban agriculture is not introduced in zoning regulations but no one has made an issue out of it because people are not really aware about it benefits. Inhabitants of urban areas need to be educated about urban agriculture as awareness of urban agriculture was found very low. Willingness of the respondents is most determined by motivators/drivers of urban agriculture and interest of the respondents whereas time spent in the household also has a mildly significant impact. The Pakistan Institute of Development Economics estimated a loss of 18 million jobs in this year. So, there is a massive need to engage people in something that will yield them some income or at least make them save money. According to the Pakistan Labor Force Survey (2017-18), the unemployment rate in the country was 5.8% (Sohail,2018) which is expected to reach 8.1% during the economic year 2020-2021 (Siddiqui, 2020).Therefore, there is a massive need to engage citizens of Pakistan in urban agriculture activities which will make them less dependent on the rural areas and would save them a lot of money which was else going to be spent on buying food items. It would make the cities self-sufficient in food and the citizens would rely less on the rural produce. Urban agriculture will make our cities sustainable. This pandemic has taught us nothing else but to make our cities sustainable and urban agriculture can play a major role to achieve that. It would also play a major role in decreasing the food miles and hence, the carbon footprint of the cities. On the other hand, the added benefit is that it is making the cities greener and cooler.

5.2 Recommendations

Ensuring urban food security can be done through establishing self-sustaining and self-sufficient cities. Urban agriculture can play a key role in making cities self-sustainable and food secure. Although urban agriculture is an old concept in most parts of the world but in Pakistan, mostly people are not aware about its advanced types and techniques. Concept of roof gardening, greenhouses and z-farming, its benefits for the environment and how they are not unsafe are also not known. First step should be

creating as much awareness as possible among the urban dwellers. Social media can be used for this purpose. Media campaigns along with posters, cookbooks, motivational phrases and television ads can help achieve awareness among the common people. Second step should be training by professionals on how to plant seeds and take care of the plants. Third step should be creating community gardens or allocating space for community gardens in places where the plot sizes are small and access to land is the major issue. Community gardens should be looked after by an association which runs by specific rules and regulations. Almost all the disputes among the urban farmers are to be handled by this association. Specific areas with boundaries will be allotted to each farmer, so that less problems occur among the farmers. Establishment of vertical farms should be the fourth step towards achieving self-sufficiency in food. Vertical farms would not take much space and would feed millions of residents food on comparatively low prices. Vertical farms can provide crops throughout the year as they are not adversely affected by the weather. It would create employment for the poor. Also, it would be a step towards eradicating poverty. Vertical farms are environment friendly and they also reduce the use of water. Water used for urban agriculture should be reused and recycled. Wastewater should be treated and used in urban farming, so that water availability no longer remains an issue for urban agriculture. Rainwater harvesting should also be given priority in urban areas. Small rain harvesting units should be installed in the houses so that rainwater does not get wasted at all. All these steps would ensure make urban farming sustainable. Land for urban agriculture should be regarded as primary or accessory use in zoning regulations of Pakistan and there should be clear and agriculture-inclusive local ordinances in Pakistan which promote local farming in urban areas. So that urban farmers do not face issues while farming on vacant lots, designated community gardening plots or even vertical farms. Also, this would make urban farmers not feel reluctant while investing in lands, building or equipment used for urban agriculture.

6. References

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Kindly fill out your personal Data   Annexure

1. Age   :_____
2. Gender   :_____
3. Income (PKR)   :_____
4. Household area   :_____
5. Number of people living in the house   :_____
6. Number of females in the household   :_____
7. Number of children in the household   :_____
8. Number of old people in the household   :_____
9. Do you own the house you are living in?   :_____
10. Since when are you living in this house?   :_____
11. Education in years   :_____
12. Field of work   :_____

To study existing conditions, willingness, drivers and barriers of urban agriculture in the considered housing societies of Lahore

13. What are your working hours if you are employed outside home?

   _____

14. How many daylight hours per week would you have available to spend on food gardening?

   _____

15. What would you use to plant seeds at home?

   a) Pots
   d) Walls
   g) a & b
   j) All the above

   b) Containers
   e) Rooftop
   h) a, b & c

   c) Vases
   f) Lawn
   i) d & e

What motivates you to do gardening? Answer the following questions based on your interest.

	Always	Often	Sometimes	Rarely	Never
16. Lack of nutritious food	5	4	3	2	1
17. High market price of food	5	4	3	2	1
18. Non-availability of fresh food	5	4	3	2	1
19. Love for gardening	5	4	3	2	1
	Always	Often	Sometimes	Rarely	Never
20. Self-reliance in food	5	4	3	2	1
21. Health concerns	5	4	3	2	1
22. Mental well-being	5	4	3	2	1
23. Finding a healthy hobby	5	4	3	2	1
24. Enhancing household's income by selling the produce	5	4	3	2	1
25. My main motivation is	_____				

Answer the following questions based on your enthusiasm in pursuing or starting urban gardening endeavor.

	Very much	Somewhat	Neutral/ Undecided/ Uncertain	Not much	Not at all
26. Do you have a profound interest in gardening?	5	4	3	2	1
27. What kind of gardening are you interested in?					
28. How enthusiastic are you to start a food garden?	5	4	3	2	1
29. How supportive is your family for your food gardening endeavor?	5	4	3	2	1
30. How much time are you willing to spend on your garden weekly?	5	4	3	2	1
31. How much money are you willing to spend on your food gardening?	5	4	3	2	1
32. Do you think you or the females of your household can be employed somehow in urban farming?	5	4	3	2	1
33. Would you allow your women to grow fruits and vegetables at a nearby community garden?	5	4	3	2	1
34. Would you allow your kids to grow fruits and vegetables at a nearby community garden during their leisure time?	5	4	3	2	1
35. Would you allow old people of your house to grow fruits and vegetables at a nearby community garden?	5	4	3	2	1
36. Do you have transport to mobilize plants and seeds?	5	4	3	2	1

Choose the best option considering your health and eating habits.

	Always	Often	Sometimes	Rarely	Never
37. Do you think you are eating enough fruits?	5	4	3	2	1
38. Do you think you are eating enough vegetables?	5	4	3	2	1
39. Are you eating enough meat and dairy products?	5	4	3	2	1
40. Do you grow fruits at home?	5	4	3	2	1
41. Do you grow vegetables at home?	5	4	3	2	1
42. Do you keep livestock (Goats, sheep, buffaloes, cow or hen) at home?	5	4	3	2	1
43. Do you think you are growing enough to meet your requirements of fruits?	5	4	3	2	1
44. Do you think you are growing enough to meet your requirements of vegetables?	5	4	3	2	1
45. Do you think gardening has improved your health?	5	4	3	2	1
46. Do you think you are healthy because you eat home grown food?	5	4	3	2	1
47. Would you prefer to get fresh food on daily basis?	5	4	3	2	1
48. How stressed are you?	5	4	3	2	1
49. Do you think gardening would lower your stress levels?	5	4	3	2	1
50. Would you interact with fellow gardeners if you work in a community garden?	5	4	3	2	1
51. Would you like to eat organic food? Organic food is the food grown	5	4	3	2	1

without the use of pesticides.					
52. Would you like to eat organic eggs?	5	4	3	2	1
53. Do you think fresh food is more nutritious?	5	4	3	2	1
54. Do you eat home cooked food?	5	4	3	2	1
55. Do you cook yourself?	5	4	3	2	1
56. How many times a day do you cook?	5	4	3	2	1
57. What do you think is the most used ingredient?	_____				
58. Do you think you can plant this ingredient at home?	5	4	3	2	1
59. Do you think you would be able to plant enough amount of the most used ingredient at home?	5	4	3	2	1

What is your knowledge about different types of urban agriculture and the ways to farm food crop? Answer the following question based upon your awareness of the concept.

	Extremely familiar	Moderately familiar	Somewhat familiar	Slightly familiar	Not at all familiar
60. Do you know what kinds of crop grows in summers?	5	4	3	2	1
61. Do you know what kinds of crop grows in winters?	5	4	3	2	1
62. Are you familiar with the ways a crop is planted?	5	4	3	2	1
63. Are you aware about the techniques used to plant a seed?	5	4	3	2	1
64. Do you know where to get the seeds from?	5	4	3	2	1
65. If you are already urban farming, do you use your walls, roofs or containers to do the activity?	5	4	3	2	1
66. Are you aware of types of urban agriculture and	5	4	3	2	1

		Yes	Somewhat Yes	Neutral	Not much	Not at all
	how they are helpful when excess land is not available?					

		Yes	Somewhat Yes	Neutral	Not much	Not at all
67.	Would you be willing to be trained by professionals to be able to grow food in the premises of your household easily?	5	4	3	2	1
68.	Would you allow women of your households to be trained by the professionals?	5	4	3	2	1
69.	Would you be willing to pay for the training?	5	4	3	2	1

Choose the best option based on the impact of household farming on your financial status.

		Very much	Somewhat	Uncertain	Not much	Not at all
70.	Do you feel that urban farming could increase your household income?	5	4	3	2	1
71.	Do you think seeds are affordable?	5	4	3	2	1
72.	Can you afford to buy grown plants?	5	4	3	2	1
73.	Can you afford the plantation cost?	5	4	3	2	1
74.	Can you afford to buy the gardening equipment?	5	4	3	2	1
75.	How much was the cost associated with farming food crops at your home on the scale of 5 (very high) to 1(very low)?	5	4	3	2	1
76.	Do you think you can save money by planting most vegetables and fruits?	5	4	3	2	1
77.	Do you think you are growing enough fruit to sell?	5	4	3	2	1
78.	Do you think you are growing enough vegetables to sell?	5	4	3	2	1
79.	Do you have a food market nearby?	5	4	3	2	1

**How much do you think environment will be benefited by growing food at home?**

	Yes	Somewhat Yes	Neutral	Not much	Not at all
80. Do you think growing food at home would benefit the environment?	5	4	3	2	1
81. Do you think growing food yourselves would decrease food miles and hence carbon footprint?	5	4	3	2	1
82. Do you think urban farming would decrease the water footprint?	5	4	3	2	1
83. Would you use water supply to irrigate your crop?	5	4	3	2	1
84. Would you use recycled water to farm food crop?	5	4	3	2	1
85. Would you be interested in rainwater harvesting using your rooftop or any other space?	5	4	3	2	1
86. Would you be interested in water recycling plant installed at your home?	5	4	3	2	1
87. Do you think the air quality of your house would get better?	5	4	3	2	1

Answer the following questions based on your knowledge of rooftop gardening

	Yes	Somewhat Yes	Neutral	Not much	Not at all
88. Do you think rooftop gardening is expensive?	5	4	3	2	1
89. Can you afford to build a rooftop garden?	5	4	3	2	1
90. Would you be willing to pay for rooftop gardens if you knew its other benefits?	5	4	3	2	1
91. Do you think rooftop gardens are safe?	5	4	3	2	1

The rooftop garden is completely safe if the weight your roof can bear has been checked by an architect or civil engineer. Among other benefits; rooftop gardens harvest the rainwater, change the ambient temperatures of the house, converts Carbon dioxide and produces more oxygen.

It has five layers:
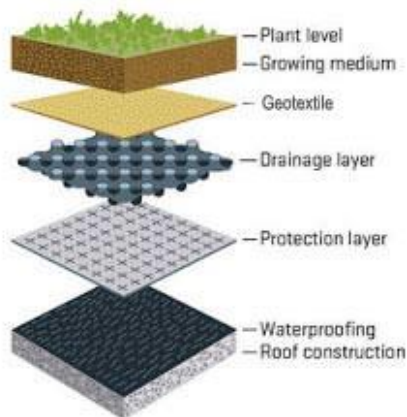
For more information visit : https://balconygardenweb.com/roof-garden-construction-step-by-step-details/

What do you think is preventing you from gardening food crop?

	Always	Often	Sometimes	Rarely	Never
92. Do you think water availability would be an issue while growing food?	5	4	3	2	1
93. Do you think the water of your house is contaminated?	5	4	3	2	1
94. If yes, do you think contaminated water would affect the growth of your plants?	5	4	3	2	1
95. Do you think you wouldn't be able to take care of the plants properly?	5	4	3	2	1
96. Do you think you won't have enough daylight hours to devote to your kitchen garden?	5	4	3	2	1
97. Do you think you are not growing food because you don't own the house you live in?	5	4	3	2	1
98. Would you prefer to involve in urban farming if access to land wasn't an issue?	5	4	3	2	1
99. Do you think your privacy will be disturbed if you or your family member start gardening	5	4	3	2	1
100. Do you think water or electricity bill will rise	5	4	3	2	1

considerably if you start planting and watering plants regularly?					
101. Do you think gardening would cause seepage in your walls?	5	4	3	2	1
102. Do you think air pollution could affect the growth of your plants?	5	4	3	2	1
103. Do you think insects (mostly mosquitos) would increase if you started a food garden?	5	4	3	2	1
104. Would you drop the idea of gardening based on the thought of increase in insects?	5	4	3	2	1
105. Do you think gardening would cause seepage in your walls?	5	4	3	2	1
106. Do you think the plants would not get enough sunlight based on the location of your gardening space?	5	4	3	2	1
107. Do you think your mobility would be an issue?	5	4	3	2	1

108. Describe your dream food garden. What do you want to achieve? Fast forward twelve weeks from today. Describe what you see. Let your imagination run riot.

_____
_____
_____
_____

109. What is your biggest obstacle to achieving your dream garden?

_____
_____